AMERICAN DYESTUFF REPORTER

"Circulated Everywhere Dyestuffs Are Used"

Devoted to the Practical Application of Dyestuffs and the Mechanical Equipment Incidental Thereto

VOL. X NEW YORK, MARCH 13, 1922 Number 6

A Few of the Important Factors Affecting the Application of Dyestuffs

Recent Paucity of Dyestuffs Has Compelled Increased Study and Knowledge of Unconsidered Substitutes —Colors in Combination Must Be Studied Separately—Cloudiness and Shadedness—Causes of Variations in Piece Dyeing—Influence of Rate of Temperature Increase —Per Cent Variation in Steam Pressure

By LEVERETT N. PUTNAM

BEING a dyer is a very interesting calling owing to the new conditions which are always coming up to be solved. It is a trade that is not learned so much by the cramming of specific, known facts as by the every-day observations as work goes on. By constant notice little features are observed, which, when added to some other more or less obscure fact of the past, make a concrete whole. These, assimilated and stored away, give untold courage and vigor to the dyer when trouble occurs and he needs all the strength and energy of his calling to keep things "right side up."

In this article I have tried to give food for thought on a few dyehouse problems which I feel sure are not at the present time understood as well as they should or could be. However, as a whole, we are surely making progress, and the time is coming when many things will be known as concrete facts which to-day are noted but not thoroughly understood.

Recent Conditions a Blessing in Disguise

As time advances, industry also advances, profiting by the mistakes of the past and by the fulfillment of the old adage, "Necessity is the mother of invention." This condition applies to the textile industry as well as to all others. It has been particularly true as related to dyestuff application in all its forms in the very recent past, owing to the extra stimulus given by the limited amount of various dyewares and the former quality of standards to which people were accustomed. It has taken all the available energy and pains of those who are in any way concerned with dyestuffs and their application to keep up to the times and to continue production with any measure of success.

This condition of affairs has been a blessing in disguise to the textile industry and the people at large, owing to the keenness of mind which it has developed all along the line—the public at large being the benefactor from the new knowledge gained and from its own new knowledge. At the present time any old thing isn't good enough. In consequence, the public is getting to-day, wherever possible, results much more satisfactory and durable than in pre-war times. As better conditions come it will, in all probability, demand a corresponding improvement.

Compulsory Education in Substitutions

One of the fundamental dyehouse troubles in the past and at the present is the application of dyestuffs to produce level and satisfactory shades. In pre-war times if such a condition of affairs arose it could be overcome by substitution of different dyes or methods, thereby overcoming the condition without tracing the trouble, in all cases, to the real cause. As the available dyestuffs became more limited, there came times when certain dyestuffs had to be applied when their use would have been frowned upon as indiscreet under normal conditions, even though the shade, when produced correctly, might be entirely satisfactory to the purchaser. As a result of this condition, numerous dyeing faults crept in where they were not wanted. Among these faults were cloudiness, shadedness, side to center, lap to lap, end to end; also shadedness from piece to piece in the same dye bath, and others which every dyer knows.

To cope with these conditions, having a limited range of colors to choose from, it can readily be seen that the dyer was more or less "up against a stiff proposition." This meant that he had to utilize all known and unknown resources to produce a satisfactory product. Investigation of the causes of trouble had to be carried deeper than ever before by all concerned. In consequence many things were learned that were helpful, not only for the time at hand, but for future times.

Cloudiness and shadedness in their several forms are in many instances entirely dyehouse faults, although not always so. Where these troubles do occur from this source they come primarily from too rapid exhaustion of color from the dye bath, caused by several conditions, such as too much acid, too sharp a rise to boil, too high a temperature, poor or uneven circulation of heat, and a few minor causes. The ones mentioned, however, are the chief evildoers. As already mentioned, in pre-war times if conditions arose where one or more dyestuffs did not fill the bill and give satisfactory results, the rest of the field was culled over and suitable dyestuffs were picked out. The trouble was thus eliminated, but the fault was not. Owing to the extra stimulus caused by the unbalanced conditions during the war, many of the trouble-making faults have been isolated and are now more thoroughly understood and are under better control.

Complications Arising from Ill-Working Conditions

The first thing to consider when trying to match any particular shade is to pick colors which will meet all requirements as regards light fastness, alkalies, carbonizing, and any others to which the goods may be subjected at any period of its usefulness. After the possible colors are isolated, the next step is to select a combination which will not only make the proper shade but which will also exhaust from the dye bath in unison. There are times when the requirements cannot be met while adhering strictly to all the above rules. Dyeing then becomes considerably more complicated, and the dyer has to apply colors together which have dissimilar properties. In such circumstances the dyeing must be carried on to favor the poorest dyeing color of the combination, making sure that the latter has nearly exhausted properly before much consideration can be given to the remaining colors in the dye bath. Attention can be given these later on, and exhaustion completed in a proper manner.

Some rather treacherous colors can be made more safe by the addition of slight amounts of alkali, the omission of the acid, or by the exact control of weak acids. Wherever possible the first two methods probably are the safest, but there are times when perfectly good colors are destroyed and their dyeing properties rendered more or less unsatisfactory. At such times a slight addition of some of the weak acids has to be resorted to. Every measure of precaution must then be taken or cloudiness and shadedness, poor penetration, etc., will surely result. To this end the rapidity with which the dye bath is raised to the boil, the rate of exhaustion at any particular temperature, and the rapidity of the boil and evenness of heat distributing, must be thoroughly studied.

Variations Occurring in Piece Dyeing

In piece dyeing it is very important that the dyer know the particular traits of every kettle which he is using. He will, in all probability, notice that, given the same conditions of stock and dyeware, he produces different results in different kettles. Sometimes this is owing to the operator and sometimes it is not. I dare say many a kettle hand has suffered a reprimand for conditions for which he was entirely blameless. It will be found that there is some underlying heat distribution which is dissimilar to the parallel kettle that causes these different results.

It might be well to mention the producing of different shades from piece to piece which occurs in the same dye solution. Every dyer is aware of this condition and has been, at times, troubled with it. In all probability it is caused more from unevenness of heat, as is the condition of different shades from kettle to kettle, than from any finishing fault which is quite often held responsible. There is a marked tendency for hot solutions in a kettle to form currents, due to radiation and the difference of temperature between the false front and back. These currents are also aided greatly by the agitation caused when steam is admitted. It is reasonable to assume that the liquor entering from the back to the front seeks out the lines of least resistance and continues in the same channels during the dyeing operation, the ingoing hot liquor circulating conversely. The consequence is that the actual dyeing is taking place at different temperatures in relation to the outgoing cooler liquor of the back to the newly heated ingoing liquor from the false front, thus giving several dyeing conditions in the same dye bath. This can be somewhat overcome by the arrangement of the kettle piping for the admission of steam and the changing of the false front to allow more even distribution of heat. The position of the dye reel is also an important factor. It will be found that if the reel is moved forward or backward, different dyeing conditions will result. All these differences should be studied and made to conform with the special problems that arise in any given case.

Influence of Temperature on Color Absorption

The next point to consider is the rate of absorption of the dyestuffs in use at any given temperature between cold and boiling. It will be noticed that some colors go on very rapidly once they have reached a given temperature, and but very little up to that point; whereas another dyestuff may be absorbed in direct proportion to the heat admitted. Consider the case, for example, of such a color as the well-known Sulphon Cyanine. In a neutral bath this color has but very little tendency to dye wool at any temperature much below the boil. From 175 Fahr. to 200 Fahr. the color begins to be absorbed, but as the boil is reached this dyestuff is absorbed very rapidly. It is evident in this case that if a rule were laid down to bring a kettle to the boil in a stipulated time, considerable valuable time might be wasted and poor results the only reward, owing to a too rapid exhaustion from overly vigorous boiling after the boil has been reached. It would be far better to come up quite hot in a short period of time, and then spend more time going through the period of exhaustion, which can be regulated at will by the proper admission of steam.

Individual Colors Must Be Studied Separately

Take, for another instance, Super Chrome Blue B, or the same color as known by other names, as dyed either on a chrome bottom or sour-dyed for chrome topping. This color has to be dyed in a weak acid bath and its absorption takes place almost completely from 150 Fahr. to 190 Fahr. After reaching the boil there is rarely more than 20 per cent of the original color still to go on. It is plainly evident that this color is taken up in a very small proportion of time, considering the time elapsed in the whole dyeing operation. If the method used in dyeing Sulphon Cyanine were applied to dyeing Super Chrome Blue B, it can readily be seen that the results could sometimes be unsatisfactory, depending on the difficulty of penetration of the cloth in question. A rule to govern the two cases would be very little better unless considerable time was wasted. Each color must be studied by itself and its properties thoroughly understood and applied as appropriately as possible. There are a number of good colors which get the name of poor dyeing colors, owing to the lack of knowledge of their proper method of application.

Value of Thorough Knowledge Is Great

It is the wish of the writer to bring out the value of as thorough knowledge as one can possibly get of the materials he is working with. All elements which enter into an operation of dyeing are of vital importance, and any or all can cause trouble at times. The one thing that can be played at will and made to yield advantageous results is steam and its distribution while dyeing. The subject of kettle design and steam circulation inside the kettle will not be discussed in detail, as it has been found that what is satisfactory in one instance, or for one line of work, will not be so for another. However, the person who does make a study of these conditions for application in his own case may rest assured that he will be well paid for his efforts.

High and Low Steam Pressure, and Per Cent Variation

Another consideration in regard to steam is variable pressure as it enters the kettle due to overloading of the steam line, and to boiler house faults. This trouble is often quite unsuspected. If using high pressure steam, this variation can be several pounds before it becomes apparent, owing to the small percentage of variation. However, if using low pressure steam, as many mills do, a variation of a pound or two either way makes the per cent variation decidedly more. In consequence the effects produced are sometimes serious, especially where every precaution possible has to be taken to insure the best results. For example, if a kettle hand had a valve set to come to the boil in a given time a five pounds pressure, and the pressure jumped to seven pounds, or down to three pounds—which is by no means an extraordinary condition—the reader can figure for himself, on a percentage basis, what would happen. When the absolute control of temperature is so vital, incidents such as these should be given more than passing notice, for one never feels sure just what has happened all through the dyeing operation, even though he has regulated the admission of steam with as much consideration as possible. The steam pressure must be kept constant or some other means of control must be substituted.

There are on the market steam controllers in which the time element has been incorporated which give good results in controlling the steam at any variable pressure and temperature. Their use is a great relief to the dyer, in that he not only controls the steam properly and thereby gets the results he is after, but moreover always knows that this part of the dyeing has been according to stipulation. Therefore, if any trouble should occur on that or any other set so controlled, his mind is positively at rest as far as steam regulation goes. If that has been at fault he can easily make the necessary charges for all succeeding batches. If not, he can look elsewhere.

ALKALIES IN VAT DYEING

L. Kollmann; Textilberichte, 1921, 2, 379; through the "Journal of the Textile Institute."

The leuco compounds are most soluble in strong inorganic alkalies, caustic soda or lime. Dyeing with vat colors is possible when the leuco compound is in complete solution or in a finely dispersed suspension. Such suspensions are obtained by decomposing the soluble vat with sodium bisuphite, bicarbonate, etc., or previous reduction in the presence of weak alkalies. Suspension vats do not give as good results as when a true solution is used. Weak alkaline vats are only required for wool. Concentrated hydrosulphite alone effects very little reduction of indigo; some weak alkali is essential—even calcium carbonate will serve. The author mentions a vat in which zinc oxide or prepared chalk are used as bases—for instance, a vat made as follows: 3 per cent indigo 20 per cent, 15 per cent prepared chalk, 10 per cent hydrosulphite on the weight of wool, in a vat 1:100 on the wool, at a temperature of 75 deg. Cent., in one hour gave a dark blue which was as fast to milling and rubbing as if dyed in an ordinary vat.

THE IMPORTANCE OF THE ADDITION OF TIN SALTS IN DYEING AND BRIGHTENING ALIZARINE RED

R. Haller; Textilberichte, 1921, 2, 427; through the "Journal of the Textile Institute."

The author has previously obtained from colloidal alumina and alizarine a body which differs from that obtained by double decomposition by its pronounced colloidal character. He now finds that on adding a few drops of a very dilute solution of alizarine to a colorless stannic acid hydrosol, shaking and standing, a

faintly opalescent solution of pronounced orange red color is obtained. Further, the calcium-aluminum alizarine lake is capable of adsorbing considerable quantities of this colloidal tin compound with considerable yellowing of shade. On heating a solution of sodium palmitate, stearate or soap with tin salts a stannic acid hydrosol is formed, capable of forming the yellowish colloidal tin alizarine compound. The author gives the following theory for the action of tin salts. The tin salts added to the soap solution form a small quantity of stannic acid sol, which forms with a small quantity of unaltered alizarine liberated from the cloth, the colloidal tin-alizarine compound of distinct yellowish red color. This is energetically absorbed by the calcium-aluminum lake, and the color changes from a bluish red to the desired fiery scarlet.

The Microscope: An Important Industrial Instrument in Analysis, Testing and Manufacture

Part II

By A. K. JOHNSON, S.B.

Lowell Textile School

"Simple" and "Compound" Microscopes—Varieties of Simple Microscopes — Spherical and Chromatic Aberration—"Virtual" and "Real" Images—Uses of Simple Microscopes—Principles of Construction of Compound Instrument—Binoculars with Paired and Single Objectives —-Applications and Accessories—Variation of Magnification

Microscopes and Some Important Accessories

A MICROSCOPE is an instrument having for its purpose the formation of an enlarged "image" of a near object. By the use of the microscope the range of human vision may be extended downward through the region of indistinct objects into the realm of the minute and invisible. The normal eye can distinguish lines ruled about 100 to the inch. This represents the lower limit of unaided vision. But, with the use of proper magnifying parts, lines ruled from 100 to 50,000 or 80,000 to the inch may be rendered clearly visible. One may, then, obtain a series of images of an object which show finer and finer detail as the magnification is increased and may derive from them much valuable information. The actual magnifications employed are, of course, selected with regard for the nature and demands of the problem being investigated.

Microscopes comprise a class of instruments. The various individual members of the class present considerable differences in outward appearances and complexity, but can all be placed in one of two groups when judged from the optical principles employed. They are either "simple" or "compound" microscopes. The simplicity of construction and of use, and the effective range of service of the two types, is widely different.

Simple Microscopes

Simple microscopes ordinarily consist of a single lens or of one group of lenses which act as a unit. This lens or lens group may be put into almost any form of mechanical holder which possesses special convenience for a particular use and often bears names which tend to show this use. Thus, of the different "glasses" on the market we find such special forms as the "pick-out glass," so mounted that when placed upon a piece of cloth the lens is in the proper position to give a sharp image. The base of these pick-out glasses often has an opening of a definite size, as one square inch, and the image of the cloth is that of one square inch. There is no need for measuring out one inch when using this microscope [see Fig. VIII, (g.)]. "Watchmakers'" or "engravers'" glasses are so made as to be easily held by the facial muscles around the eye, thus leaving both the operator's hands free for work. "Reading" glasses, "Coddington," tripod" and "pocket" magnifiers, "thermometer readers" and "dissection microscopes" are common names applied to simple microscopes of a given design.

A lens or lens combination may be made to give two kinds of images. One shows the object right side up ("erect"), the other shows it wrong side up ("inverted"). Each type may usually be obtained by making a proper, but different, arrangement of distances between the lenses, the object, and the eye. The erect image is called a "virtual" image, because it can be seen by the eye but not readily shown on a screen or ground glass. The inverted image is called "real" because it can be seen and also thrown upon a screen.

The quality of the image produced by a lens may be impaired because of two troublesome properties of lenses. One trouble tends to produce distortion, giving an untrue representation as to shapes and positions, and is called "spherical distortion" or "spherical aberration." The second trouble tends to produce colored borders and is known as "chromatic aberration." Great care is taken by the reliable makers of microscopes to reduce these troubles as much as possible in any given grade of instrument, and optical parts which have been so corrected bear special names like "aplanatic" where the correction

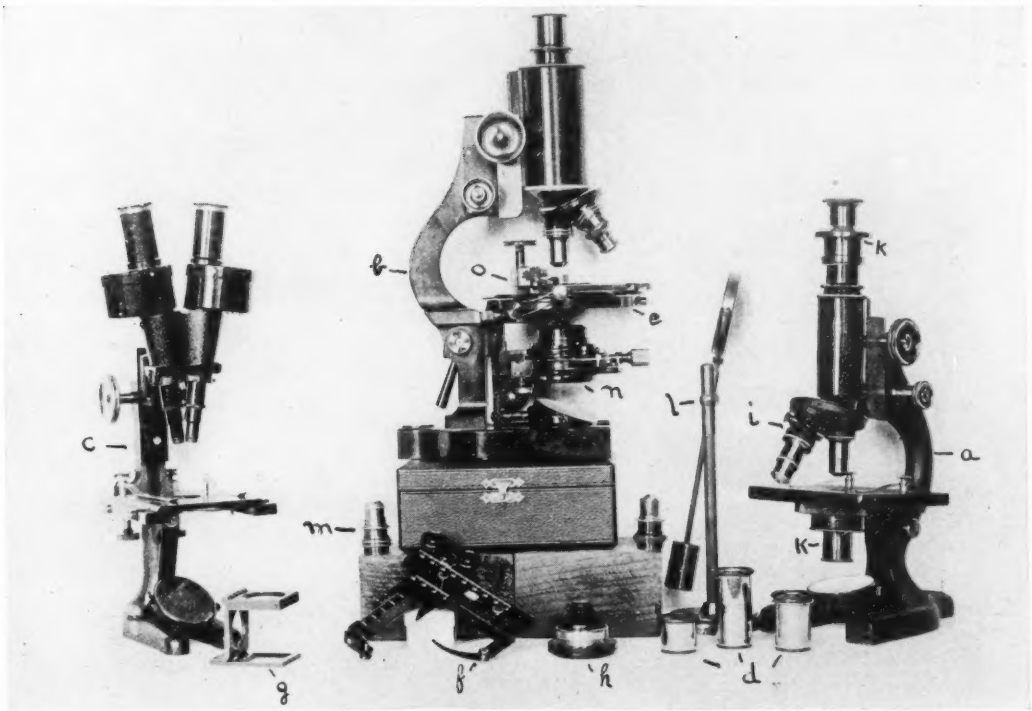


FIG. VIII—*Showing a Few Models of Simple and Compound Microscopes and Some of the More Important Accessory Apparatus*

(a) An ordinary form of compound microscope having attached to it both a polarizing apparatus (k, k) and a vertical illuminator (i).
(b) Another model having a very complete substage condensing apparatus (n) for intensifying the light, a circular revolving stage (e) and a mechanical stage (o).
(c) A binocular microscope with paired objectives and oculars.
(d) A series of oculars. The shorter the length the higher the magnifying power.
(f) A detached mechanical stage for square-cornered stages as on model (a).
(g) A simple microscope ("pickout glass").
(h) An Abbé condenser, detached. Compare with (n).
(i) A vertical illuminator, attached, for reflecting light downward upon opaque objects like metals.
(l) A mounted bull's-eye condenser to intensify light.
(m) A detached objective.

for spherical distortion is obtained by grinding operations, or "achromatic" or "apochromatic" when chromatic aberration has been reduced to a minimum.

In simple microscopes the virtual image is the one most commonly employed for visual use. It shows the object right side up, as in ordinary life. The simplicity of construction of this form of microscope does not afford opportunity for the makers to overcome chromatic aberration—in powers of magnification over twenty—sufficiently to make the image at higher enlargements a satisfactory one to use. Simple microscopes are therefore usually found furnishing a magnification of under twenty and more frequently at ten or under. They are of "low power." Co-related with their low power they show a relatively large area when in focus; they have a large "field." Further, the free space between the lens and the object is usually large and permits of the use of tools or instruments which can be readily seen. The light needed for the image is easily regulated without special apparatus, and any reasonable movement of the object is not particularly troublesome to the observer. All of these properties of simple microscopes—erect image, low power of magnification, large area visible with plenty of light easily obtained, the use of the tools permitted, and the possibility of considerable movement in the object—tend to make their use easy and natural. They are extremely serviceable in working operations upon indistinct materials, or in the examination of indistinct crystals, written characters, engravings, abrasions and the like.

COMPOUND MICROSCOPES

In order to obtain satisfactory images of much higher magnifications than is practical with the simple microscope, the compound microscope is used. The optical principle of the compound form is much more complex than that of the simple type. It employs two separate groups of lenses, one at a definite distance above the other. [See Fig. IX, (copied from "Use and Care of the Microscope." Bausch & Lomb Optical Company).] The lower group, the "objective," forms an enlarged, real (inverted) image of the object at such a height that the upper group, the "ocular" or "eyepiece," uses this real image as its object and in turn forms an enlarged,

virtual image of it. The final magnification is thus the combined effects of the two groups. By means of this more complicated system the effects of spherical distortion may be reduced to a negligible quantity, and that of

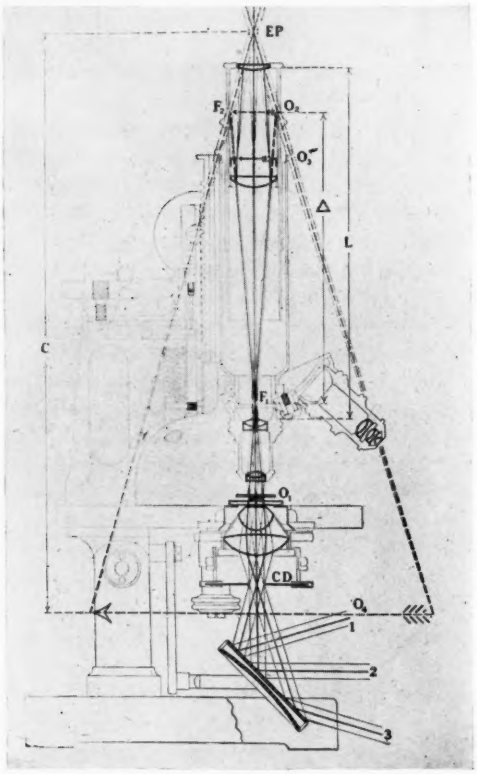


FIG. IX (*from Bausch & Lomb Company Pamphlet, "Use and Care of the Microscope"*)—*Showing Optical Effects of Objectives and Oculars. The Construction of Mirrors, Condenser, Objectives and Oculars Is Also Shown.*

Index to Diagram)

F_1	Upper focal plane of objective.
F_2	Lower focal plane of eyepiece.
Δ	Optical tube length=distance between F_1 and F_2:
O_1	Object.
O_2	Real image in F_2, transposed by the collective lens, to
O_3	Real image in eyepiece diaphragm.
O_4	Virtual image formed at the projection distance C, 250 mm from
EP	Eyepoint.
CD	Condenser diaphragm.
L	Mechanical tube length (160 mm).
1, 2, 3	Three pencils of parallel light coming from different points of a distant illuminant, for instance, a white cloud, which illuminate three different points of the object.

chromatic aberration to the utmost possible minimum.

Compound microscopes may be obtained in two general types, the "binocular" type and the monocular, or ordinary form.

Binocular microscopes have paired oculars so that both eyes may be used at the same time in making the examination. The earlier models also have paired objectives, giving a view of the object from two different directions (a so-called sterescopic effect) which is at times an advantage. [See Fig. VIII (c).] These models have a range of magnifying power from 8 to 150. [See Table 1 (from catalogue of Spencer Lens Company).] Later models of binocular instruments do away with the paired objectives. They are "mon-objective." They use the same kinds of objectives that the ordinary form of compound microscope uses and have the same range of magnifying power. The paired oculars are retained, and with them an apparent stereoscopic effect.

The ordinary form of compound microscope is by far more commonly met with. It is made in a wide variety of models which differ mainly in design and quality of parts, and in the style, character, and amount of accessory equipment provided. If the equipment has been chosen to facilitate a certain kind of work, then the model may be given a name implying this use. For example, chemist's microscope, metallurgical, petrographical and biological microscopes, may all use identical kinds of objectives and oculars and have the same ranges of magnifications, but the selection of accessory equipment is made for the more common needs in each field. A chemist's microscope can do metallurgical or biological work if the same kind of equipment is at hand, and vice versa.

TABLE 1

Showing magnifications of binocular microscopes with paired objectives (from Spencer Lens Company catalogue)

Table of Magnification Binocular Microscopes

Paired Objectives	Oculars							
	4x	5x	6x	8x	10x	12x	15x	20x
55 mm.	8	10	12	15	19	22	27	38
48 mm.	11	12	15	21	25	29	36	58
40 mm.	13	18	22	27	34	40	51	68
32 mm.	20	24	29	35	46	52	69	92
25 mm.	30	37	45	60	74	90	117	148

The magnification obtainable with a compound microscope for usual use ranges from 8 to 2,200. It may best be varied by using different objectives. Objectives may be "chromatic" (uncorrected), "achromatic," or "apochromatic," the last two having different degrees of correction for chromatic aberration. They may also be "dry" or "immersion," the latter being of the very highest magnifying power and requiring the use of a fluid between the bottom lens and the object. Each objective usually has but one power of magnification, but each one in a series is of different power. [See Table 2 (from Bausch & Lomb Optical Company's catalogue).]

The second best way of varying the magnification is by using different oculars from a series, each one having a higher magnifying power. [See Table 2, and Fig. VIII (d).] The magnification may also be varied by a third way, which consists in changing the distance between the ocular and the objective, for visual use, or by changing the point at which the image is caught upon the camera screen, as in micrographic work. For visual use the distance between the ocular and the objective is ordinarily 166 mm. The figures in the table refer to a "tube length" of 160 mm.

As the power of magnification is increased, the size of the field becomes smaller, the amount of light needed becomes greater and more difficult to supply, the free distances between the objective and the object become very small and the disturbing effect due to uneven motion or differences in levels in the object becomes more unbearable. For these reasons the need for mechanical devices to hold the object steady, to furnish sufficient light for the examination and to furnish this light from the proper direction, and to provide means of making fine adjustments of distances with the microscope proper, as in focusing, becomes more and more urgent. The compound microscope is furnished with these.

The instrument may be divided into two parts, one known as the microscope proper, the other as the "stand." [See Fig. X (from Bausch & Lomb Company).] The microscope proper consists of a body tube with a sliding inner tube ("draw tube") to regulate the distances between the optical parts, the ocular and the objective. These are at either end of the body tube. An accessory "nose piece" permits the fixing of two or three objectives ready for use, which may be brought into use by swinging around the pivot point. The microscope proper is attached to the stand by a rack, by means of which the microscope may also be raised up and lowered.

TABLE 2

Showing magnifying powers of objectives and oculars alone and when combined. Also gives, in mm., the diameter of field when instrument is in focus (from Bausch & Lomb Company catalogue.)

Table of Magnifications and Real Fields

Tube length = 160 mm. Projection distance = 250 mm.

Objectives		Eyepieces				
E. F. in millimeters	Initial Magnification	5×	6.4×	7.5×	10×	12.5×
48	2	10× 10.5 mm	13× 9.0 mm	15× 8.5 mm	20× 8.5 mm	25× 6.8 mm
32	4	20× 5.5 mm	26× 4.8 mm	30× 4.3 mm	40× 4.4 mm	50× 3.5 mm
16	10	50× 2.10 mm	64× 1.85 mm	75× 1.70 mm	100× 1.74 mm	125× 1.38 mm
8	20	100× 1.02 mm	130× 0.90 mm	150× 0.83 mm	200× 0.85 mm	260× 0.67 mm
4	43	215× 0.48 mm	275× 0.43 mm	320× 0.39 mm	430× 0.40 mm	560× 0.32 mm
3	57	285× 0.36 mm	365× 0.32 mm	420× 0.29 mm	570× 0.30 mm	740× 0.24 mm
1.9	95	475× 0.22 mm	610× 0.19 mm	720× 0.17 mm	950× 0.18 mm	1260× 0.14 mm

The stand supports the microscope proper, and supports and includes all the other accessory apparatus, which is attachable to it, needed in holding or manipulating the object, providing the light, and moving or focusing the microscope. The simplest and usual equipment provided with the stand consists of the focusing apparatus for moving the microscope, the stage for holding the object, and a double mirror and an adjustable diaphragm below the stage for regulating the light. [See Fig. VIII (b), also Fig. X.]

SOME IMPORTANT ACCESSORY APPARATUS

1—*Apparatus for Manipulating Object on Stage*

The usual form of stage is square or rectangular. The object may be revolved or moved to and fro by hand when only low or moderate powers of magnification are being used, but with the higher powers and in making fine adjustments, as in measuring objects, it is not altogether feasible to do it in this manner. Much better results can be obtained by using accessory apparatus. Under this heading would come such apparatus as a revolving stage

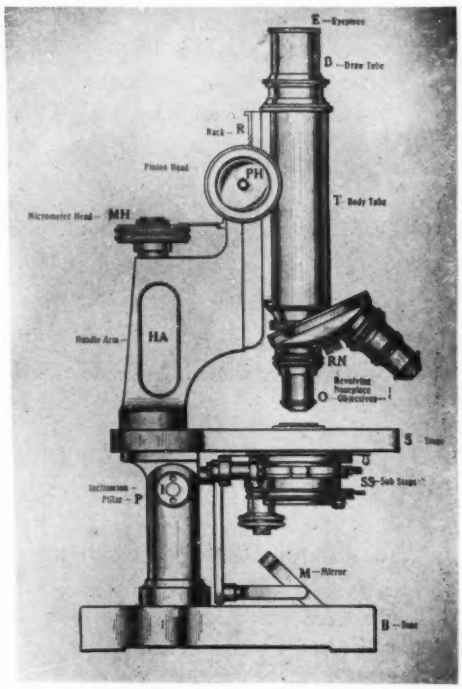


FIG. X (*from Bausch & Lomb Company Pamphlet, "Use and Care of the Microscope")—Showing Names and Positions of Parts*

which may or may not have a graduated scale showing degrees of rotation. This revolving stage may be permanently fixed or may be of the readily attachable type. [See Fig. VIII (e).] Another device known as a mechanical stage is also attachable and helps greatly in moving the object to and fro across, or forward and back, on the square cornered stages. [See Fig. VIII (f).]

2—*Illuminating Apparatus*

The intensity and often the direction of light used in microscopic examination may be varied by the use of mirrors or of condensers of the bull's-eye, or Abbe, types [see Fig. VIII (f and h)] by diaphragms or by "vertical illuminators" if the object is opaque and the light must be reflected from the surface. [See Fig. VIII (i).] Special effects are obtained with "dark ground illuminators," with polarizing apparatus [see Fig. VIII (k)], with micro-specrometers, etc.

3—*Measuring Devices*

The measurement of the angles in crystalline materials is accomplished with the polarizing apparatus and its

parts. Linear measurements showing lengths and diameters are commonly done with glass slides or discs which have fine scales graduated upon them. If these scales are of known dimensions for each optical combination, then the number of divisions which the object covers may be counted and an idea gained as to its exact size. The scales on the slides are used on the stage and are called stage micrometers. The discs are frequently put into the ocular and then are ocular micrometers.

Applications

Compound microscopes and their accessories are of good service whenever minute objects are being worked with or where minute detail of structure or arrangement in larger objects is desired to be seen. Much of micro physical and chemical testing, as well as the examination of minute biological products, chemicals, powders, emulsions, yarns, fabrics, rubber, leather and paper goods, is done with the compound microscope.

(*Part III will follow in the next issue.*)

Modern Views on Soap

Part III

Tests for Determination of Washing Power—Difficulty of Judging Soaps—Potash vs. Soda Soaps—Solvent Scouring—Dry Cleaning—Note on an Effect of Hard Water—Effect of Time—Ordinary Soaps

(*Continued from page* 156.)

By CHARLES F. GOLDTHWAIT

Chemist, Klearflax Linen Rug Company, Duluth, Minn.

Volatile Solvents in Scouring

SOLVENT additions to the scour have been rather widely advertised and while the amount used is frequently small and may not exert much actual solvent action on the relatively large amount of oil present, it does have a valuable function in helping to reduce the surface tension and thereby improving penetration.[11] For instance, when the surface tension of water is represented by 80 units, that of water containing soap is about 30, and a suitable solvent still further reduces it. The result is to get behind the dirt more easily and remove it from the goods. Such a solvent can be conveniently added by using one of the proprietary articles made from monopole oil and carbon tetrachloride or similar compounds.

We have now seen that the newer methods of chemistry and physics have brought out a number of ideas on soap that have or are destined to have an important bearing on its use in textile mills. Among the largest users of soap are the manufacturers using animal fibers, particularly wool, with its scouring and fulling. They also are necessarily among the most particular, as a slight degree of alkalinity may do a large amount of damage if the wool is exposed to it under just the right conditions, or soap made from a poor quality fat may make itself very evident later when the goods are taken out of storage, where they have developed a vile odor. Rancid fats often yield poor lathering soaps as well as leaving offensive smells in the fabrics.

In the past, mill men have made many rather dogmatic assertions about the soaps that they have used, and there is no doubt that some chemists have been equally sure of numerous "things that were not so." Fulling and scouring overseers who have insisted that the purchasing department procure neutral potash soap and who have then proceeded to mix it with relatively large proportions of soda ash before using are now, thanks partly to the war with its potash famine, in a dwindling minority. These men were certainly wrong in ascribing any real virtue to the presence of potash under these conditions. On the other hand, they have been perfectly correct in insisting on the use of certain soaps when the chemist tried to substitute other brands of higher fatty acid content and apparently better money value. Such substitutions have not always been successful, often for reasons that are even yet not well understood. For practical purposes it is still impossible to state positively from any form of laboratory tests just how, for instance, a soap will behave in the fulling mill, or which of two soaps will be best for scouring, unless there is some very obvious difference between them.

Soaps are still largely bought on faith, without any definite quantitative standard of washing power. At least five general methods have been proposed for such a determination based on measurement of some colloidal property, but rapid, accurate methods are still lacking as well as rules for interpreting the data.

Briefly, the tests that have been proposed are: Comparative washing tests, which are extremely difficult to standardize or control; chemical analysis, which takes no account of colloidal factors; strictly colloidal methods like the protective action toward colloidal gold, or the drop pipette which measures surface tensions; the solubility of soaps or tenacity of jellies of standard strength, which are obviously incomplete; and, finally, a method similar to the hardness test, that measures the amount of

[11] Schofield. J. S. D. C. December, 1921. Page 300.

soap required to obtain a foam under certain standard conditions, and, although crude, is considered the best single test. Here is a wide open field of research for some one with a good supply of patience.

The writer recently experienced a good example of the difficulty of judging soaps. Cocoanut oil soap is less hydrolyzed than those from most other fats. It would, therefore, be expected to have less action on the skin than the others if used in a toilet soap. Actually, however, it has a more irritating effect than the others, and more than could possibly be due to the alkalinity developed in solution. A liquid soap bought for factory washrooms was called too "strong" and was said to affect the hands. It tested well below a Government specification[14] of 0.05 per cent potash as caustic, and alkaline salts equal to 0.30 per cent figured as potassium carbonate. During experiments on the manufacture of a substitute a very "neutral" soap was made from fat containing a rather large proportion of cocoanut oil. A test showed it well under the above alkali limit, but it felt on the hands as though it contained free caustic. The trouble was evidently due to a specific effect of cocoanut oil.

Apparently manufacturers of toilet soap containing cocoanut oil overcome the difficulty by proper blending. Hurst and Simmons[15] also state that more than 25 per cent of cocoanut oil should not be used in toilet soaps, as a larger amount is liable to irritate sensitive skins. Such a phenomenon would ordinarily be ascribed to the free alkali, and only serves to show how easily one can be misled in the investigation of such complicated materials as soaps.

Potash vs. Soda Soaps

Tradition says that potash soaps are better for wool than soda soaps. While some authorities consider the matter open to doubt, the fact remains that there are differences in the solutions of the two kinds of soaps We have all read that hard soaps are made from soda and that soft soaps are made from potash. The writer, however, has had very little respect for this statement since the time when, fresh from school, he reported a certain soap, soft enough for anyone, as containing a certain amount of potash, only to discover later that it was merely a soda soap with an extra large amount of water.

Besides this obvious difference that does apply to the two kinds of soap under comparative conditions, there are more subtle differences. A 5 per cent solution of ordinary soap gelatinizes at the average temperature, while a 20 per cent potash soap will still pour. The sodium soaps become colloidal sooner than the corresponding potassium soaps because the latter are more soluble in water and tend to yield true solutions over higher ranges of soap concentration than the sodium soaps.[1] There are differences in their lathering properties as affected by temperature and concentration of solution, and we have already mentioned a difference in our discussion of curd fibers. There is, then, a possibility that some of the differences claimed in practical use may have a basis in fact.

Up to the present, however, the reason why soft soaps are better for wool than hard soaps, leaving it with a softer feel and a more silky luster, has not been definitely settled.[15] It has been suggested that the glycerine which is left in the soap during manufacture has some influence, but the usual quantity, about 4 per cent, seems too small to exert any marked effect. That potash soaps are actually any better is doubtful. For example, claimants for success in using potash soaps in scouring have been found to use hard soda soaps for fulling the same goods, which would seem to destroy any previous effect of the potash.

The chances are that their reputation has been built up largely on experiences that are not really comparative. Such an impression might easily be created by the fact that potash soaps are usually made of low melting fats that work well at low temperatures and are so readily soluble at these temperatures that they easily wash out.

Solvent Scouring—Dry Cleaning

In the removal of greasy matters by volatile solvents the tendency is for the solvent to take out the grease, but to leave some of the dirt which may be protected by a film of water. This difficulty is overcome, especially in dry cleaning, by dissolving a soap in the solvent. Ordinary soaps are not soluble in such a solvent, but a special oleate soap containing an excess of free acid is readily taken up, also some of the metallic soaps like magnesium. The explanation of this action has been recently given.[2] The solvent itself dissolves the grease and oil in the ordinary way, but the moisture which all textiles contain must be emulsified before the non-greasy dirt can be removed. A pure solvent will dissolve small amounts of it and carry larger amounts in suspension. In the presence of benzine soap this takes place more easily; the soap attracts the water and readily emulsifies it, carrying away the dirt at the same time. With ordinary soap it is emulsion of oil and dirt in water, and with benzine soap an emulsion of water in a solvent.

An Effect of Hard Water

While a discussion of water softening and hard water hardly belongs in this review, a recent observation[16] is of rather special interest. All discussions of water softening harp on the fact that lime and magnesium salts in water cause a great waste of soap. This is granted without further discussion, but a point about which we hear less may be of some interest, namely, the attraction of the insoluble calcium and magnesium soaps to the washed

[1] Fischer. "Soaps and Proteins." Wiley, 1921.

[14] Bureau of Standards Circular 62. "Specifications for and Methods of Testing Soaps."

[15] Hurst and Simmons. "Textile Soaps and Oils." 1921. Page 90.

[2] Darke, McBain and Salmon. Proceedings of the Royal Society. March 3, 1921. "The Ultramicroscopic Structure of Soaps."

[16] Chemical Abstracts. Vol. 15, 2992.

goods. It is stated that new shirts contain ½ to 3 per cent ash, while old ones run from 7 to nearly 9 per cent, a sufficient difference to be quite convincing.

Effect of Time

The chemist who thinks in terms of ordinary chemical reactions is apt to underestimate the value of the factor, time, which is one of the most significant in treating colloids. It is of particular importance in making soap and perhaps in using it. Storing a cold, clear transparent solution of red oil soap and finding a white opaque mass after a few days shows clearly that time produces changes in soap masses.

A matter like the boiling of a fulling soap for a long period after solution is apparently complete does not seem necessary, but, like many other empirically established ideas, it may find a justification in practice and an ultimate explanation in colloid chemistry even though contrary to ordinary chemical notions.

Ordinary Soaps

Having considered soaps made from pure fatty acids and some soaps prepared for special purposes, a few notes on ordinary soaps may not be out of order. Good red oil can be actually made into a soap about as easily as harder soap can be merely *dissolved,* and for many purposes its cleansing action is better. It is well known that ordinary tallow soap is very much improved from the washing point of view by the use of 5 or 10 per cent of cocoanut oil in its manufacture.

Ordinary soaps are mixtures, and usually contain a little of each of the ordinary fatty acids. McBain says that commercial sodium soaps contain as sole structural constituent, hydrated curd fibers, with enmeshed liquor which is a sol, or more frequently a gel, of the various more soluble soaps and salts present, while Fischer states that the ordinary bar of pure soap is essentially only a solid "solution" of water in a mixture of sodium soaps. When used, the more readily soluble come out first, thus favoring disintegration of the bar for the production of the hydrated liquid colloid required for washing.

In this way the soap will answer all ordinary requirements. Soaps of the lower fatty acids assist in foaming and emulsifying quickly at low temperatures. They dissolve quickly, however, and are liable to be wasted, as in warm water they pass into true solution. Soaps from the fatty acids from the middle of the series now become effective. These in turn lose some of their virtues if the temperature is raised, but as the boil is approached the soaps of the higher fatty acids like palmitic and stearic are most effective. A soap can therefore be made for a special purpose or, though less economically, for almost universal use.

Much further work on soap is under way by different investigators, and a Part II of the "Colloidal Chemistry of Soap" is promised for a future British Association Report. When it appears, it can be counted upon as one of the most authentic sources of the very latest information. More familiarity with such work and more interest in it will hasten the time when we shall all thoroughly understand the soaps that we use every day.

[The End]

The Effect of Scouring and Bleaching Upon the Structure and Strength of Cotton Fabrics

Delivered Before the Manchester Section of the Society of Dyers and Colourists, and Printed in the Journal of the Society

By J. HUEBNER, M.Sc.Tech., F.I.C.

THE methods of scouring cotton fabrics employed in the industry differ materially, and, since no exact data were available as regards the loss in weight and the effect of different processes upon the strength and the structure of the fabrics, a number of scouring experiments were carried out in order to ascertain the effect of steeping, malting and of different methods of boiling.

It was found that the following process produces the greatest freedom of the scoured fabric from oils, fats, starches and other ingredients used in sizing the warp, with the least reduction in its strength:

1. Steep.—Run the cloth into the open kier and boil lightly overnight with 1 per cent of soda ash.
2. Run out of the kier, through rope washing machine, back into the kier.
3. First Boil.—Boil for about 12½ hours in the open kier with 1½ per cent of caustic soda and 1½ per cent of soda ash.
4. Run out of the kier through rope washing machine.
5. Sour with 1½ deg. Tw. hydrochloric acid.
6. Run through the rope washing machine back into the kier.
7. Second Boil.—Boil in the open kier for about 12½ hours with 3 per cent of soda ash.
9. Pass through water mangle.
10. Dry on the cylinders.
8. Run through the rope washing machine until free from soda (usually four times).

11. Impregnate with a solution of sodium acetate in the water mangle.
12. Stenter and dry on clip stenter.
13. Damp slightly.
14. Plait and measure.

The impregnation with sodium acetate (11) was carried out in order to counteract any acid which might be liberated in processes through which the fabrics had to pass later on. It was found that this did not affect the strength or the properties of the fabrics under consideration.

Four types of fabric (I, II, III and IV) were first examined and the investigation was then extended to a fabric woven from finer yarns (V) scoured by the above process, and to five fabrics (VI to X) which have passed through different processes or boiling and bleaching in order to ascertain the effect of other methods of boiling, as well as that of bleaching, and to obtain a comparison between the changes produced by the special method of scouring and the methods commonly used in a bleach works.

It is proposed to deal first with the differences between the gray and the scoured fabrics, and later on with the changes which have taken place in each of the different operations.

In order to appreciate the effect of scouring on the number of warp and weft threads per inch (ends and picks), it should be pointed out that the number of warp threads in any one piece cannot vary greatly, because the weaving reed strictly spaces them. The difference never exceeds two threads, and rarely exceeds one thread to an inch, which is negligible. The variations are, however, considerable when one piece is compared with another piece of the same quality.

The following table gives the number of warp threads per inch found in the four qualities tested:

	Highest.	Lowest.	Mean of all the Samples Tested.
I.	137	121	127·6
II.	130	115	122·0
III.	144	122	130·0
IV.	136	120	128·3

The number of weft threads per inch varies (a) in a single piece and (b) in different pieces of the same quality. The former is due to defective weaving, the latter to irregular structure.

The variations in the number of weft threads per inch found in pieces in the loom state are:

	Greatest Variation.	Least Variation.
I.	12 (136 to 124)	0 (127 to 127)
II.	7 (115 to 108)	1 (115 to 114)
III.	12 (133 to 127)	0 (130 to 130)
IV.	8 (151 to 143)	0 (132 to 132)

As will be seen from the following table, the variation in the number of weft threads per inch in different pieces of scoured fabrics is considerably greater than in the loom state:

	Highest.	Lowest.	Mean.
I.	125·6	108·6	122·0
II.	124·2	102·2	114·1
III.	141·0	120·4	126·1
IV.	145·0	125·6	136·1

The scouring is responsible for an increase in the number of warp threads per inch and a decrease in the number of weft threads per inch, because as a rule the length of a fabric increases during scouring, while its width decreases.

	Increase in Warp Threads per inch.			Decrease in Weft Threads per inch.		
	Maximum.	Minimum.	Mean.	Maximum.	Minimum.	Mean.
I.	8	1	5·4	11·0	1·0	4·1
II. ...	8	1	4·9	16·8	0·6	5·0
III. ...	7	1	4·9	12·0	0·6	4·2
IV. ...	8	1	5·5	8·8	0·6	4·2

It has been found that attempts to stenter the scoured fabric to its gray width invariably result in reducing its tensile strain weft way.

Experiments have, therefore, been carried out in order to ascertain the width to which each type of fabric may be stretched out on the stenter without reducing its tensile strain in the weft way appreciably. The results are as follows:

	Grey.	Scoured.
	In.	In.
I.	44·47	42·50
II.	43·96	42·13
III.	43·95	42·13
IV.	43·91	41·25

The shrinkage in the case of IV, the finest fabric, is greater than in the heavier fabrics I, II and III. In order to obtain the most satisfactory result as regards tensile strength in the weft way it will, therefore be necessary to make allowance for this in the construction of these fabrics.

Valuable information in regard to the changes which occur in a fabric during scouring may be obtained by ascertaining the regain in the warp and weft. This is the difference between the length of a fabric and the length of a thread when removed from that fabric.

The regain may be an indication of good or bad weaving, for if the regain in the warp and in the weft of a scoured plain fabric is not the same the elasticity of the fabric will differ in the two directions. If the

regain in the warp exceeds greatly that in the weft, it may be assumed that during weaving the tension upon the warp was insufficient. If, on the other hand, the regain in the weft greatly exceeds that in the warp, it may be taken that the tension on the warp during weaving has been excessive.

The mean changes in regain in all the samples tested are as follows:

	Warp.		Weft.	
	Grey.	Scoured.	Grey.	Scoured.
I.	17·9	13·2	7·8	10·9
II.	12·6	10·2	7·2	10·5
III.	14·4	7·4	7·8	10·7
IV.	8·4	5·4	8·2	11·4

The mean changes in regain, in per cent, effected by scouring are:

	Warp.	Weft.
I.	−26·03	+39·7
II.	−19·05	+45·8
III.	−48·61	+37·2
IV.	−35·72	+38·8

It will be noticed that in each quality the difference between the regain of a gray and a scoured fabric is considerable. The regains in warp and weft in the gray fabric are entirely due to the conditions which obtained in the loom. The difference is greatest in I. It becomes less in II and in III, while it is nearly equal in IV.

These conditions are reversed in the case of the scoured fabrics.

The loss in tensile strain and the change in elongation, or stretch, at the breaking point due to scouring of fabrics I to IV is given in the following tables:

Tensile Strain (2 in. Strips)

Woven from Single Yarns.

	Warp.			Weft.		
	Grey. Lbs.	Scoured Lbs.	Loss in %	Grey. Lbs.	Scoured Lbs.	Loss in %
I.	149·00	142·0	4·69	160·9	146·2	9·13
II. ...	129·73	120·3	7·26	132·6	121·1	8·67
III. ...	95·90	89·9	6·25	100·0	88·0	12·00
IV. ...	76·10	70·3	7·62	80·1	71·4	10·86

Woven from Folded Yarns

III. ...	98·10	93·6	4·58	108·2	93·6	13·49
IV. ...	80·00	77·8	2·75	75·6	70·3	7·01

It will be noticed that the loss in tensile strain in the warp way is least in the heaviest fabric, I, woven from the coarsest yarn, and that it is less in pieces woven from folded yarns than in pieces woven from single yarns.

Elongation.

Woven from Single Yarns.

	Warp.			Weft.		
	Highest.	Lowest.	Mean.	Highest.	Lowest.	Mean.
I. Grey ...	26·7	17·0	22·1	15·1	9·2	10·9
I. Scoured ...	22·6	14·2	16·8	19·0	13·4	15·9
II. Grey ...	22·2	12·0	18·4	13·3	9·8	11·2
II. Scoured ...	17·6	12·0	14·2	17·8	12·0	15·4
III. Grey ...	20·9	10·0	14·1	12·3	6·4	10·7
III. Scoured ...	14·0	8·0	10·3	16·3	10·3	14·8
IV. Grey ...	15·2	8·4	11·1	13·4	8·9	10·7
IV. Scoured ...	9·6	6·2	7·4	17·8	9·8	15·1

Woven from Folded Yarns.

III. Grey ...	17·8	12·2	15·3	9·5	6·4	7·7
III. Scoured ...	14·0	8·9	12·2	14·0	10·3	11·8
IV. Grey ...	14·2	12·3	13·0	8·3	5·8	6·8
IV. Scoured ...	10·3	9·6	9·9	9·4	8·2	8·8

The mean loss or gain in the elongation at the breaking point of the fabrics, in per cent, is therefore as follows:

Woven from Single Yarns.

	Warp.	Weft.
I.	−24·0%	+45·8%
II.	−22·8%	+37·5%
III.	−27·0%	+38·3%
IV.	−33·3%	+41·1%

Woven from Folded Yarns.

III.	−20·4%	+53·2%
IV.	−24·0%	+29·7%

When considering the total loss of weight, in per cent, which results from scouring, it should be pointed out that manufacturers were instructed to use the smallest possible amount of size. The total losses in weight are, therefore, comparatively speaking, small. They are as follows:

I.	10.15%
II.	11.08%
III.	10.86%
IV.	10.15%

If we now calculate the mean reduction in tensile strain from the data given above, by adding the tensile strain of warp and weft, and by dividing by two, we obtain the following results:

I.	6.93%
II.	7.98%
III.	9.13%
IV.	9.25%

A comparison of the mean tensile strain with the

(*Continued on page* 199.)

AMERICAN
DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

LOUIS A. OLNEY
PROFESSOR OF CHEMISTRY AND DYEING, LOWELL TEXTILE SCHOOL
Advisory Editor

LAURANCE T. CLARK
Managing Editor

Published biweekly by

HOWES PUBLISHING CO., INC.
4109 Woolworth Building, New York City

A. P. HOWES, *President* E. S. PREDMORE, *Secretary*

Subscription price $5.00 per year; Canadian $5.50; foreign $6.00.

Vol. X March 13, 1922 No. 6

WHAT DOES SENATOR KING WANT?

AFTER many days devoted to the taking of testimony, briefs, assertions, statements, charges, counter-charges and sundry declarations and cross-questionings, the King dye investigation, as it was inevitably bound to do, is at last beginning to assume sufficiently definite shape to permit of its real status being appraised. And a careful appraisal of its status, as an investigation, would seem to indicate at the present writing that it is not going to produce the resounding detonation in dye or other circles which was so confidently predicted by its instigator last year.

Judging solely from the published reports of the proceedings thus far, it is the view of many that the element which for the sake of convenience may be referred to as the prosecution, has shown a striking lack of the threatened fury in its attack—has, in fact, given a very definite impression of having decidedly "hauled in its horns"; whereas the element which for want of a better term may be designated as the defense, has not been shaken from its original position.

This result—and more particularly, the mildness of the prosecution—was foreseen almost from the very day that Senator Frelinghuysen metamorphosed the King dart into a potential boomerang. There were many who upon that occasion agreed that whether the Utah Senator really expected to reveal and prove the existence of a dye monopoly, or whether he merely hoped to derive whatever political capital might accrue from getting the industry under fire, Senator Frelinghuysen had in any case taken all the fun out of the game by lining up the King supporters alongside the target, where they would be in imminent danger of injury from shafts too sharply pointed or too vigorously propelled. Some such thought may have been in the mind of Senator Ashurst when, on resigning from the committee, he characterized the amended King resolution as "a flaccid, denatured, disembowled affair—a resolution with clipped claws and drawn teeth."

It is entirely possible, of course, that the investigation may yet produce the promised sensation. But if its distinguished promulgator cherishes any hope of this, he masks it well under his latest attitude toward the affair, which is puzzling, to say the least.

The details of what has transpired have been available to the reader through the daily press in the form of a "close-up." We invite him for the present to a consideration of the view from a little distance, so as to obtain a better perspective of the broader masses.

Throughout the opening days the Utah Senator maintained the floor practically to the exclusion of all others. Some did speak, it is true, and there was some questioning, but in the main Senator King held steadily on as the chief actor in the drama of denunciation. He was not under oath, and, thus unhampered, he attacked the Textile Alliance, the Chemical Foundation and the American Dyes Institute. He attacked the Chemical Warfare Service and in turn the conduct of Alien Property Custodians Mitchell and Garvan. He said the Du Ponts were "destroyers of industry." He produced a chart, pointed to a line running from a square marked "Alien Property Custodian's Office" to another labeled "Chemical Foundation," and said this showed how Francis P. Garvan had become president of the Foundation—a bit of subtle reasoning which at once cleared away what has hitherto, of course, been an impenetrable mystery, and which was enjoyed by his auditors, no doubt, to the utmost, for various and possibly conflicting reasons.

However that may be, Senator King was given every chance to say all that he might have in mind, and when he was through, and Mr. Garvan was permitted to testify in reply, he listened until he could apparently restrain his impatience no longer, and then demanded to know whether "the subcommittee was really a body charged with the purpose of investigating and probing charges of monopoly, graft, lobbying, etc.," or "rather a committee with the sole purpose of giving Francis P. Garvan and other gentlemen in the dye and chemical business an opportunity to make speeches and plead for protection for their industry?"

Continuing, he said: "It is evident that the so-called probe is becoming nothing more than a committee for the purpose of listening to speeches. The witnesses are permitted to make statements and place in the records balance sheets, records, etc., of their financial transactions, against which charges have been made, without apparently any challenging or perusal of the papers which are entered as evidence."

That is hardly living up to the rules of the game. But it is less astonishing, for all that, than his complete indifference to the opportunity freely offered him to cross-examine the witnesses himself. To this work, he lets it be known, he "will be unable to devote his time."

Just what does Senator King expect the committee

to do? What is it he wants, further than the receipt of sworn testimony and a chance to question the testators? It is all so different from what both trade and public had been led to expect that it fairly takes one's breath away. There was much talk of "proofs" in the past. The Utah legislator submits his unsupported word as to the existence of a dye monopoly, but not one tangible proof. The dye industry submits sworn financial statements bearing directly upon the King charges. No need for the committee to "dig" for information. It is brought to them—showered upon them. And before the committee the twain are equal. What more can the committee do to establish or disprove the truth of that information? Actual arrest of the industry's representatives would reveal nothing more than would a cross-examination by those making the charges. Yet, provided with an opportunity to do this, Senator King weakly backs down and actually appears to avoid confronting those whom he had accused.

From all of which one may be quite justified in concluding that the real driving power is indeed gone from the King investigation. Indications are strongly in support of the intimation made in these columns that the King forces, seeing the turn affairs had taken after the Frelinghuysen amendment was adopted, and being unable to stop the investigation without a serious loss of prestige, were resigned, in the popular argot of the day, to "let it ride"—and eventually to play itself out.

The situation is well summed up by Senator Shortridge, chairman of the committee, who says: "Senator King was allowed more time to make his statement than any other witness, and was not required to take oath. The testimony of the other witnesses is given under oath which goes into the record. This record, which also contains all statements and printed evidence, will be thoroughly examined by the committee."

We believe that what Senator King now wants most of all is to see the investigation safely over, and that without being placed in a position where he may have to submit to questioning as to the basis of his charges himself. He promised "many new revelations," but so far has done no more than to repeat all his old repertoire of stock assertions. The trade has been eager to hear these revelations, eager to testify and eager to aid the investigators in every possible way.

We have no desire to be unduly abstruse, but believe it desirable to point out that when the instigator of an investigation like the present one begins to refer to it as a "so-called probe," his peculiar choice of words cannot but have its own significance in the minds of those who have been following the dye controversy carefully throughout the many months of its existence. For who was to have made this probe so potent, if not Senator King himself?

It would not, on the whole, be surprising to discover that Senator King wants very much to "pass the buck" to the committee, and to get gracefully away from the affair as soon as he can conveniently do so.

Correspondence

DR. HERTY'S JERSEY CITY ADDRESS — AN ADDITIONAL WORD FROM MR. ZINSSER

[Letterhead of the Synthetic Organic Chemical Manufacturers' Association of the United States]

February 26, 1922.

To the Editor of The Reporter:

In connection with the communications from Dr. Ernster and others, I would appreciate your publishing the attached communication.

Chas. H. Herty, President.

[Letterhead of Zinsser & Co., Hastings-on-Hudson, N. Y.]

February 21, 1922.

To Dr. Charles H. Herty:

You have no doubt seen the various letters in the American Dyestuff Reporter of February 13 written by Mr. Nobbe, Dr. Ernster, and the fourth person, who is Dr. Walch; and also a letter from the Chemische Fabrik Greisheim Elektron. I do not know whether you think it is worth while to answer these letters.

It seems to me that the matter has come down to a question of veracity between Dr. Ernster and the men in my office, and I want to say to you in very plain language that this man is simply trying to get out from under.

Whether he told the truth in our office, or whether he is telling the truth now, is a matter which I cannot decide; but I do know that he did not tell the truth both times.

We naturally cannot know whether Mr. Seebohm made the remarks attributed to him, nor do we know whether Dr. Ernster interviewed Von Weinberg or his representative, but we do know what he told us, and I should like very much to be confronted with this gentleman and get him to explain how it is he recognized himself in the statement you made, although his name was never mentioned and he was not told by any one of us that we had communicated with you.

Furthermore, I should like him to explain his letter to our Mr. Lehmann in which he said: "He might have given a lot of additional information."

Dr. Ernster says that so far as he is concerned, the matter is closed. I have no doubt that is what he would like best.

I am not willing to have both my son and Mr. Lehmann left in the embarassing position they are in now. Dr. Ernster came up here unsolicited. He did not have any conversation with Mr. Lehmann before or after he was in the room with my son, and his statements were made voluntarily, and not as the result of any questions that were put to him.

Like very many of his countrymen, he may have said

these things to make himself important, and there may not be anything in all his various statements; but the fact that these statements were made, remains.

I am perfectly willing to have you publish this letter, and stand ready to further substantiate each statement made by us in this matter.

I am at your disposal at any and all times.

F. G. ZINSSER.

THE EFFECT OF SCOURING AND BLEACHING UPON THE STRUCTURE AND STRENGTH OF COTTON FABRICS

(*Continued from page* 192.)

weight of the fabrics per square meter shows that the mean ratio of the breaking strain of the gray fabrics to that of the scoured fabrics is less than the ratio of the weight per square meter of gray to that of the scoured fabrics.

As a rule, the losses in tensile strain in the warp vary more than those in the weft. This is, no doubt, due to the removal of the size, added before weaving, which varies both in quantity and in composition.

While in the great majority of cases scouring is responsible for a reduction in the tensile strain, it should be mentioned that in a few samples a gain has actually been recorded. Examination of these fabrics has shown that in some cases excessive shrinking in the width of the fabrics had taken place, with the result that the 2-inch strip of the scoured fabric contained a greater number of warp threads than that of the gray fabric.

In other cases, excessive shrinking had taken place in the length of the fabric, which resulted in an increase in the number of weft threads.

It is important to remember that the actual loss in tensile strain, due to scouring, is greater warp way and less weft way than that shown in the tables, for the reason that under normal conditions, contraction in width and extension in length takes place during scouring.

The effect of scouring upon the counts of warp and weft—or, in other words, upon the weight of the yarns—is given in the following table, in which (a) gives the highest percentage of variation in one piece, (b) the lowest percentage of variation in one piece, and (c) the mean percentages of all the losses or all the gains:

	Warp.			Weft.		
	(a)	(b)	(c)	(a)	(b)	(c)
I. Single ...	−37·7	− 8·00	−20·0	−14·9	−0·0	−5·4
I. Folded	− 4·6	− 2·85	− 3·72	− 5·4	−5·4	−5·4
II. Single ...	−29·3	− 6·60	−21·50	−23·0	−0·9	−5·5
III. Single ...	−33·0	−11·10	−20·86	−36·4	−0·0	−4·5
III. Folded	−17·0	− 2·10	− 7·90	− 5·9	−0·0	−4·0
IV. Single ...	−39·3	− 7·70	−29·40	−15·3	−2·0	−4·8
IV. Folded	− 8·8	− 7·70	− 8·00	− 1·7	−1·7	−1·7

While in no case has it been found that warp yarns become heavier in scouring, some such cases have been recorded in weft yarns.

The gains have been as follows:

	(a)	(b)	(c)
I. Single ...	+ 1·9	+1·4	+1·65
I. Folded ...	+ 1·5	+1·5	+1·50
II. Single ...	+ 7·1	+0·8	+4·20
III. Single ...	+ 9·4	+0·6	+4·40
III. Folded ...	+ 8·0	+8·0	+8·00
IV. Single ...	+10·9	+0·4	+5·10
IV. Folded ...	+ 5·0	+2·6	+3·80

The gains are, without doubt, due to excessive shrinkage of these fabrics in the width

Taking the gains and the losses together, the mean percentage losses in the weight of all the yarns tested are as follows:

	Warp.	Weft.
I. Single	−20·00	−4·25
I. Folded	− 3·72	−1·95
II. Single	−21·50	−3·40
III. Single	−20·86	−2·34
III. Folded	− 7·90	−0·98
IV. Single	−20·40	−2·08
IV. Folded	− 8·00	−1·96

The mean loss in weight of the warp and weft yarns in all the fabrics is, therefore, as follows:

	Warp.	Weft.
Single	−20·69%	−3·915%
Folded	− 6·54%	−2·630%

It has thus been established that in all the fabrics tested, scouring removes about 3 per cent of impurities from single yarns, and that any loss above 3 per cent is due to the removal of the size contained in the warp.

Folded yarns show a smaller loss in scouring than single yarns. In the case of the weft, this may be attributed to the greater compactness of the fibers in the thread. The difference in the case of the warp is greater because folded yarns can be conveniently woven with a smaller percentage of size.

Fabric V is woven from finer yarns than those used in the manufacture of fabrics I to IV. From the complete particulars given in Table A it will be seen that, with the exception of the single thread tensile strain of the weft, which, as in other cases, is higher in the scoured than in the gray fabric, scouring has resulted in a decrease in strength similar to that of fabrics I to IV. The loss is greatest in the ripping strain warp way (17.5 per cent).

The loss in elongation in the tensile strain in the warp is increased to 61 per cent, and the gain in elongation in the weft way is increased to 55 per cent, and the loss in regain in the warp is increased to 57 per cent and the regain in the weft to 55 per cent.

TABLE A.

Grey.	Weight per Square Metre. Grms.	Tensile Strain.		Tensile Strain Elongation %.		Ripping.		Single Thread Tests.		Ends.	Picks.	Counts.		Regain.	
		Lbs. Warp.	Lbs. Weft.	Warp.	Weft.	Kilos. Warp.	Kilos. Weft.	Ozs. Warp.	Ozs. Weft.			Warp.	Weft	Warp.	Weft.
Mean of I., II., III., and IV.	95·3	112·7	118·4	16·4	10·9	1·32	1·19	3·8	2·92	126·0	126·0	65·12	72·1	13·3	7·8
V.	53·6	63·5	59·4	12·6	8·4	1·12	0·97	3·72	2·60	123·1	139·0	101·4	131·6	8·1	6·8
Mean of VI., VII. & VIII.	125·0	94·8	95·8	21·9	17·6	1·94	1·47	6·9	3·5	67·4	67·6	21·7	24·7	—	—
IX. ...	167·0	45·0	32·8	10·0	13·0	1·33	1·10	3·2	1·7	57·2	54·8	32·0	46·0	—	—
X.	140·0	82·1	71·3	11·0	12·5	1·52	1·25	4·0	2·0	76·0	76·0	22·0	30·0	—	—

Fabrics VI, VII, VIII, IX and X have been woven from coarser yarns, and the number of ends and picks is considerably less than in fabrics I to V.

VI, VII and VIII (lime boil) have been treated as follows:

Boiled in lime.
Soured.
Boiled in soda ash.
Chemicked.
Boiled in soda ash.
Chemicked.
Soured.

IX (lime boil), short bleach, has been treated as follows:

Boiled in lime.
Soured.
Boiled in soda ash.
Chemicked.
Soured and washed.

X (caustic soda boil) has been treated as follows:

Boiled in caustic soda.
Soured.
Chemicked.
Boiled in soda ash.
Chemicked.
Soured.

While the results of testing a fabric in the gray and in the scoured or bleached condition show the final effect of all the operations through which it had to pass, it seemed to be of interest to ascertain the effect on its properties produced by each of these operations.

The results of these tests are given in the graphs. and in order to allow of a more ready comparison of all the fabrics tested the results have been calculated in per cent. taking the gray fabrics as 100.

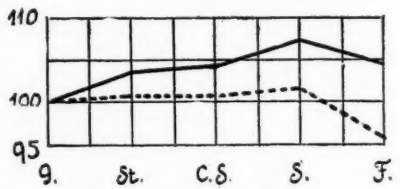
———————— represents the warp.
— — — — represents the weft.

The following abbrevations have been used:

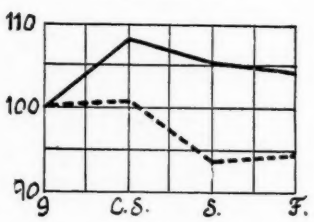
G. = gray
St. = steep.
L. = lime boil.
C. = caustic soda boil.
S. = soda ash boil.
C.S. = caustic soda and soda ash boil.
Ch. = chemic.
S.Ch. = soda ash boil, chemic and sour.
Sr. = sour and finished.
F. = finished.

As has already been pointed out, the number of warp threads per inch in a scoured fabric which has not been unduly stretched on the stenter increases, while that of the weft threads decreases. In I to IV the number of warp threads per inch increases steadily during the steep, the combined caustic and ash boil and the ash boil. The stentering ultimately somewhat reduces their number.

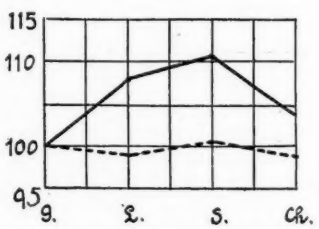
The number of weft threads per inch is little affected until the final operation, when a decrease, similar to that observed in the warp, takes place.



I., II., III., IV.



V.



IX.

Fabric IX (short bleach) behaves very similar, but the decrease in the number of weft threads per inch is slightly less.

(To be concluded.)

Milan Dyers Strike When Wages Are Cut to Meet Italian Industrial Crisis

Shortage of Electric Current Hampers Production—Consumers of Dyed Goods Continue Too Poor to Buy —Color Prices Rise in Company with Exchange Values—Mordants, Assistants, Etc., Remain Stable Owing to Adequate Supply

By RAFFAELE SANSONE

Genoa, February 8, 1922.
Special to The Reporter.

THE last thirty-eight days provided many difficulties for Italian industries in general, and especially for the dyestuff industry. The scarcity of electric current continued, being little improved upon despite the importation of 150,000 kw.-hr. from Switzerland, the imposition of special limitations, the reduction of electric train service, and the working of old and new generating plants using coal, benzine, petroleum, heavy oils and weak fuels. The lower wages paid in rival countries and the consequent difficulty of competing with the prices of imported colored goods caused the employers in the dye works to refuse an increase in the wages of their workpeople, and to arrange a month's notice in cases of dismissal. This arrangement met with the disapproval of the dyers, especially in the Province of Milan, where they went out on strike, suspending all dyeing operations. In addition to the above, orders for colored goods were greatly limited owing to the reduced financial strength of the consumers, the majority of whom were obliged to practise the strictest economy in order to weather difficult financial conditions caused by the crisis in all industries.

Prices of Coal-Tar Dyes

A regain in the value of the Italian lira which brought the United States dollar from 24.50 lire to 21.50 lire, the English pound sterling from 97.50 lire to 91.50 lire, the French franc from 1.87 lire to 1.80 lire, and the German mark from 0.12 lira to 0.11 lira, increased, as can be seen from Table I, the dollar prices of colors per ton from the beginning of January to the date of writing.

Mordants, Assistants, Dyehouse Products

Despite the further regain in the value of the Italian lira, little change followed in the lira prices of mordants, assistants and dyehouse products owing to the small necessity of importing the same, the stocks available being often sufficient to meet all demands. Some of the lira and dollar quotations are given on the following page, per ton at Milan.

TABLE I

	Jan. 1 to Feb. 8 (lire)	January 1 (dollars)	February 8 (dollars)
Naphthol Yellow	50,000— 70,000	2,040—2,857	2,325—3,255
Auramine	70,000— 80,000	2,857—3,265	2,325—3,255
Orange II	30,000— 35,000	1,224—1,428	1,395—1,628
Nigrosine, water soluble	30,000— 40,000	1,224—1,632	1,395—1,860
Nigrosine, soluble in alcohol	35,000— 40,000	1,428—1,632	1,628—1,860
Sulphur Black	7,000— 10,000	285— 408	325— 465
Acid Black	35,000— 40,000	1,428—1,632	1,628—1,860
Direct Black	35,000— 40,000	1,428—1,632	1,628—1,860
Chrome Black	40,000— 45,000	1,632—1,836	1,860—2,093
Methylene Blue	80,000—100,000	3,265—4,080	3,720—4,651
Direct Blue	25,000— 30,000	1,020—1,224	1,162—1,395
Sulphur Blue	45,000— 50,000	1,836—2,040	2,093—2.325
Malachite Green	80,000—100,000	3,265—4,080	3,720—4,651
Acid Green	60,000— 70,000	2,448—2,857	2,790—3,255
Direct Green	50,000— 70,000	2,040—2,857	2,325—3,255
Bismarck Brown	40,000— 50,000	1,632—2,040	1,860—2,325
Magenta (Fuchsine) Crystals	70,000— 80,000	2,857—3,265	3,255—3,720
Eosine	60,000— 80,000	2,448—3,265	2,790—3,720
Ponceaux	35,000— 45,000	1,428—1,836	1,628—2,093
Methyl Violet	70,000— 80,000	2,857—3,265	3,255—3,720

TABLE II

	February 8 (lire)	February 8 (dollars)		February 8 (lire)	February 8 (dollars)
Acetate of alumina	1,600	74	Bisulphite of soda, 32 deg. Be.	400	18
Chrome alum	3,000	139	Chlorate of potash	3,500	162
Bichromate of potash	6,000	279	Chloride of ammonia	5,000	232
Ferrous sulphate	500	23	Bleaching powder	900	41
Copper sulphate	2,450	114	Nitrite of soda	3,000	139
Tartar emetic	12,000	558	Yellow prussiate of potash	13,000	604
Aniline oil	10,000	465	Yellow prussiate of soda	9,000	418
White refined glycerine	9,600	446	Caustic soda, 70/72	2,700	125
Glucose, 45 deg. Be	3,900	181	Silicate of soda, 140 deg. Tw.	1,000	46
Hydrogen peroxide	2,100	98	Sodium sulphide	3,250	151
Tannic acid, 60 per cent	20,000	930	Logwood extract	10,000	465
Tartaric acid, crystals	10,750	500	Yellow dextrine	3,900	181
Acetic acid, 30 per cent	2,500	116	White dextrine	4,000	186
Hydrochloric acid, 20-21° Be.	300	13	Farina	3,400	158
Formic acid	11,000	511	Kordofan gum	4,900	227
Lactic acid, 80 per cent	4,000	186	Indigo, 25 per cent	23,400	1,089
Alum	1,000	46	Beta-naphthol	18,000	837
Ammonia, 22 deg. Be	1,550	72	Industrial castor oil	5,000	232

NEW NATIONAL BULLETINS DESCRIBE NATIONAL WOOL GREEN S, QUINOLINE YELLOW AND SULPHUR BLACK R

Three new bulletins of the National Aniline & Chemical Company, now ready for insertion in the company's loose-leaf binder, describe respectively National Wool Green S, National Quinoline Yellow, and National Sulphur Black R.

National Wool Green S will be of interest to dyers of woolen and worsted yarns and constitutes a valuable addition to the company's line of acid dyes because of its excellent level-dyeing properties and all-around good fastness. It may successfully be employed in the production of mode shades on worsted or woolen dress goods, and is one of the few dyes which may safely be added to the boiling dye bath for shading purposes. It will also be found suitable for dyeing weighted or unweighted silk, as well as of service to the dyer of carpet yarn. After-treatment with bichromate somewhat improves its fastness to light and washing without materially altering the shade.

National Quinoline Yellow yields the clearest and greenest shade of the acid yellows and may be used on wool or silk, wherever a level-dyeing yellow of extremely bright and greenish shade is required. It will be found entirely suitable for dyeing combination shades. It possesses moderate fastness to light and washing, and is equal in all respects to the European products marketed as Quinoline or Chinoline Yellow. Further use for this product is found in the leather, paper and lake industries.

National Sulphur Black R is a new type of Sulphur Black producing a distinctly red shade which should be most desirable. The complete solubility of this product in comparatively small amounts of sodium sulphide makes it valuable for the dyeing of raw stock in vacuum dyeing machines, as well as for yarns in beam and cop dyeing machines. Its easy-leveling qualities make it, likewise, suitable for the dyeing of warps and piece goods.

DR. J. A. AMBLER COMPLETES COMPILATION OF AMERICAN DYE PATENTS

Dr. Joseph A. Ambler, acting chemist in charge of the Color Investigation Laboratory, Bureau of Chemistry, Department of Agriculture, has finally completed a compilation of the American patents on dyes.

Dr. Ambler is a graduate of Sheffield Scientific School, Yale, and taught chemistry successfully in a Nova Scotia College before doing important research work in a big Poughkeepsie, N. Y., plant before the war. He has written valuable treatises or dye methods and qualitative detection, having been awarded patents for several discoveries along these lines.

The Government plant at Arlington is now utilized for research and experimental work, the present research having to do with questions of supplies of intermediates. These experiments are carried on in the building on the grounds of the Arlington Experimental Farm, Arlington, Va.

The laboratory is investigating the methods of manufacture and preparation of dyestuffs and, more especially, their intermediates, also the study of raw materials found or produced in the United States. Particular stress is laid on the fundamental study of the physical and chemical properties of these substances, and of the important reactions used in their manufacture.

This is a field which industrial concerns often have not the time or means of entering. As a result of these studies, new methods of testing some of the reaction mixtures obtained in manufacturing operations, such as sufonations and chlorinations, have been devised. New and im-

proved methods of manufacture have also been worked out for a number of important intermediates, such as the production of phthalic anhydride by the catalytic vapor phase, oxidation of naphthalene with air, also the vapor phase sulfonation of organic compounds.

A new series has been successfully worked out, called the kryptocyanines, which has a characteristic absorption maximum and sensitizing maximum in the infra red.

Just now the laboratory is working especially on the production of furfural from corn cobs, and studying all possible uses of this former chemical curiosity, with very promising results. The substance has been shown to have a possible use as a solvent for resins, as a raw material for synthetic resins, both of the type of bakelite or condensite, fusible types, which have possible uses as varnishes and enamels.

But an especially practical work done by this laboratory is the compilation of national dye patents, which have been abstracted under seven different headings, in order to make the compilation accessible from as many points of inquiry as possible. The abstracts have been typed on cards 3 by 5 inches. Hence any desired patent may be found under any one of the following headings:

1. Scientific name; when known or given in the patent.
2. Intermediates used, with a very condensed statement of the method of manufacture.
3. Class of dye, according to Schultz's eighteen chemical classes.
4. Color of dye.
5. Method of use.
6. Fiber or material for which suitable.
7. Name of owner and, in parenthesis, name of patentee.

The abstracts and the compilation as a whole are not intended to do away with the consulting of the patents themselves, but merely to serve as a helpful cross-index to them. At the same time, the cards contain sufficient information to enable the user to decide which of several possible patents is the one he may be looking for, without the necessity of handling the patents themselves.

CAMPBELL ISSUES FOLDERS FOR AMIDINE FAST GRAY BN, BORDEAUX, AND VIOLET B, R AND N

Amidine Fast Gray BN, Amidine Bordeaux, and Amidine Violet B, R and N, are three of the colors marketed by John Campbell & Co. described in folders just issued to the trade for inclusion in loose-leaf binder files. These folders, in addition to containing dyed patterns and descriptions, also include methods of application of the colors described.

Amidine Fast Gray BN is a new direct cotton dyestuff possessing excellent leveling properties and good fastness to light, alkali, acetic acid and hot pressing. It is a recognized standard for cotton piece dyeing by the pad method, and on account of its good solubility is suitable for machine dyeing. It is also favored for the dyeing of mixed fibers composed of cotton and silk, and cotton and artificial silk hose, since it dyes all fibers uniformly.

Amidine Bordeaux should be of interest to dyers of carbonized shoddy and other mixed fibers such as cotton and silk hosiery, because of its excellent covering power. Solid shades are obtained at low dyeing cost. It is likewise a standard product for cotton raw stock, particularly Canton flannels and other napped goods, as well as for yarn dyeing. The company warns users, however, that this color is *not* fast to acid, and care should be taken in handling it, as with Congo Red and other sensitive colors.

The company's three straight direct dyeing Violets are useful for practically all forms of cotton dyeing, mixed fibers and artificial silk. Amidine Violet B is the bluest type, and serves pad dyers and discharge printers to good advantage. The shade turns redder when "hot pressed," but returns when cooled. It possesses normal fastness to light, good fastness to acetic acid, and discharges a clear white with hydrosulphite. It is also recommended for "burl dyeing" of woolen goods. Amidine Violet R is a good product for mixed fiber dyeing. It possesses good fastness to light and to acetic acid. The shade is fast to hot pressing. It is serviceable for lilacs and heliotropes on cotton raw stock, roving, and yarns for underwear. On account of its good solubility and leveling qualities it is recommended for machine dyeing. Amidine Violet N is valuable for the gingham and corduroy trades, being generally recognized as a color possessing good fastness to light. Cotton and wool are dyed practically the same shade. Its fastness to acid, alkali, washing and hot pressing is good, and it discharges well with hydrosulphite.

The firm name of Henshall Bros. Silk Finishing Company, dyers and finishers, Paterson, N. J., has been changed to Henshall Bros., Inc.

The Westminster Textile Company, Boston, Mass., and Cumberland, R. I., has been incorporated, with capital of $40,000, by Charles Chell, Lowell, Mass.; Samuel Siskind, Boston, and Leon W. Mowry, Slatersville, R. I.

The interest of Carson & Toy, proprietors of the Fairmount Dye Works, Philadelphia, Pa., dyers and bleachers, has been purchased by Arthur J. Boyer and Murray Gibson, Jr., who are operating the plant under the name Fairmount Dye Works.

J. & P. Coats, Inc., Pawtucket, R. I., have awarded the contract for building a new bleachery. The latter will be one story, of brick, 105 x 316 feet. The J. W. Bishop Company, Worcester, Mass., has the construction contract.

The International Chemical Products Company, San Fernando, Cal., has been incorporated with a capital of $250,000. The incorporators are Arthur G. and Bernard A. Munn and H. J. Poppelman, all of San Fernando.

Textile Alliance Publishes Dyestuff Transactions to Refute Kuttroff-Pickhardt Charges

OWING to the public nature of its dyestuff operations, the Textile Alliance, Inc., feels that it should make public a resume of its operations since it took charge of the importation and distribution of Reparation Dyes, at the request of the State Department.

The following tabulation of licenses, or permits, issued by the Dye and Chemical Section, Division of Customs, Treasury Department, shows that during the year 1921 there were issued to the Textile Alliance, Inc., less than 16 per cent of the permits issued during 1921 for the importation of dyestuffs.

This statement confirms what is widely understood among dyestuff consumers—namely, that the Textile Alliance, Inc., imports and distributes only a very small percentage of the total amount of foreign-made dyes sold in this country, which amount is shown from official records to be less than one-sixth of the total.

The statement made before the subcommittee of the Committee on Judiciary of the United States Senate by the Counsel for Messrs. Kuttroff, Pickhardt & Co., Inc., to the effect that no German-made dyes were imported into America except through the Textile Alliance, Inc. (page 614, Testimony; February 28, 1922) is thus shown to be untrue.

The great importance of this 16 per cent lies not in its volume, but in the fact that not being under the control of the German Cartel it is invaluable in controlling prices of dyes not made in the United States and preventing the re-establishment of the German monopoly.

The scope and magnitude of these operations are clearly set forth in group order in the table below.

Messrs. Barrow, Wade, Guthrie & Co., C. P. A., have furnished a certificate which is on file with the subcommittee of the Committee on Judiciary showing that the statements given wide circulation (Exhibit—Testimony. March 3, 1922) to the effect that the Textile Alliance, Inc., is engaged in a general dyestuff business, purchasing dyes from many sources and selling them in many countries, are entirely untrue. The only purchase from any source except the Reparation Commission, and an option

Table

Dye Operations of Textile Alliance, Inc., from 1919 to February 16, 1922

	Pounds	Period of Transactions	Pounds Sold	Sold for
Reparation dyes—				
300 tons	348,322	(December, 1919	348,322)	
		(to	)	$3,836,373.70
Herty option	835,611	(October, 1921	835,611)	
Reparation (underwritten) dyes—				
1,200 tons	223,812	April 15, 1921, to date	178,061)	
1,500 tons	264,743	July 15, 1921, to date	229,967)	
Daily production	379,888	Dec. 1, 1921, to date	371,882)	2,640,497.84
Exchange	527,576	July 1, 1921, to date	224,430)	
First manufacturing program	165,671	Oct. 1, 1921, to date	41,396)	
Indigo (sold to China)	961,115	July 16, 1920–Dec. 30, 1920	961,114	705,975.27
Total received	3,706,737	Total sold	3,190,783	$7,182,844.81
		Total on hand	515,954	
Unfilled orders for reparation	197,799	Total on order	197,799	
Grand total	3,904,536		3,904,536	
Deduct Indigo	961,114			
Balance dyes	2,943,422			
Deduct unfilled orders	197,799			
Balance dyes received	2,745 623	Insured (selling) value, goods on hand		1,262,696.74
Deduct Herty option	835,611			
Total reparation dyes other than Indigo	1,910,012	Total selling value of goods sold and on hand		$8,445,541.55

secured direct from the German manufacturers by a representative of the Department of State, was two small lots bought from the French Government through the Union Des Matieres Colorantes. The only lot sold elsewhere than in the United States was one lot of 961,114 pounds of Indigo sold to China.

The Textile Alliance, Inc., has substantial stocks of dyes either in New York or on order, which should reassure consumers as to their future needs of necessary types not made in this country.

Licenses Issued 1921

	Pounds	Total Pounds
Licenses issued to T. A. I. for import from Germany	327,598	
	401,783	
All other licenses issued for import from Germany	1,671,134	
Total from Germany		2,400,515
Licenses issued to T. A. I. for import from France	30,043	
All other licenses from France	9,352	
Total from France		39,395
Licenses issued for import from England, Switzerland and others		2,268,605
Grand total		4,708,515

Per cent to Textile Alliance, Inc., 15.5 per cent.

NEW DOUBLING MACHINE FOR SILKS, DOUBLES AND TWISTS IN ONE OPERATION

The Scranton Silk Machine Company is showing a new "Duplex" machine which embodies entirely new and patented principles for doubling and twisting silks in one operation.

Two or more threads are drawn from the bobbins on the jack pins through a positive and quick-acting stop motion by two "take-up" rolls, which are driven by a bevel gear, and are engaged or disengaged by the action of the stop motion. These take-up rolls are driven through a direct gear ratio from the spindle belt. This assures a positive delivery of silk to the spindle at all times.

The change of twist is accomplished by inserting a new or intermediate gear (according to twist chart) on shafts which are readily accessible on the end stand. This controls the speed of the "take-up" rolls and thence the delivery of silk to the spindle. The spindles are mounted on a swing bracket and driven by a whorl of one inch diameter, assuring a uniform spindle speed.

The traverse rails are driven by a cam on the head end of the machine, and is most accurately built mechanically for a uniform motion. The brackets carrying the builder rings are mounted individually for each spindle and allow adjustment for any unevenness in the building height of the bobbin.

The "stop mechanism" is an absolute control for each spindle unit, from the threads on the jack pins through the take-up rolls to the bobbin on the spindle. The spindle comes away from the belt and rests against a brake, stopping the revolving bobbin and preventing hard twist. The spindles are spaced 4½ inches on the machine for six and eight thread doubling and 5¼ inches on ten and twelve thread doubling, which minimizes the possibility of the ends becoming entangled and thus causing a kick-off.

The machines are arranged for drive by individual two horse-power or by belt from the line shaft. Ball bearings are used on driving parts to reduce power requirements to a minimum.

The standard machine is built as follows: 100 spindles on frame for six and eight thread doubling, 22 feet 10 inches long, 1 foot six inches wide; 86 spindles on frame for ten and twelve thread doubling, 22 feet 10 inches long, 1 foot 6 inches wide. The length covers the total outside dimensions, including drive pulleys or motor. The shipping weight is 2,700 pounds.

Three sets of twist gears are furnished as part of the regular equipment; extra gears upon request. The traverse stroke, size and type of ring are furnished to meet the specific requirement.

NOTES OF THE TRADE

The Silk Yarn Trading Company, 121-131 West Nineteenth Street, New York, doing a thrown silk business exclusively, has recently enlarged its raw silk throwing facilities The company has leased for a term of years the premises at York Avenue and East Eighteenth Street, Paterson, N. J., where, with the latest improved machinery, it will materially increase its production of thrown silks.

According to a British patent, a process has been invented for the manufacture of viscose silk into fine threads below six deniers by using spinning apertures of about 0.10 mm. diameter, feeding the viscose to the nozzles in exact quantities according to the desired denier, and using dilute sulphuric acid as the spinning bath. The finer the thread desired the higher the concentration of acid in this bath.

The final official general memorandum on the indigo crop of 1921-22, based upon reports received from provinces containing practically the whole area under indigo in British India, refers to the crop which is now being marketed. The total area is estimated at 316,600 acres, which is 32 per cent above the finally revised area of last year. The total yield of dye is estimated at 60,900 cwt. (90,900 factory maunds), as against 41,200 cwt. (61,500 factory maunds), the finally revised estimate of last year

on an increase of 48 per cent. The season was, on the whole, favorable and the condition of the crop is reported to be generally good.

A copper drying can, charged with steam, recently exploded at the plant of the Windsor Print Works Division of the Consolidated Textile Corporation, North Adams, Mass., causing injury to John T. Pratt, aged sixty-five, from which he subsequently died. Four other employees of the plant were more or less seriously hurt by the explosion, but the splendid service rendered by the corporation's welfare nurses did much to lessen the severity of the injuries sustained by these men, and, it is said, all will recover.

It has been semi-officially announced that no American Silk Mission will go to Japan this year. American silk manufacturers are not prepared just now to go further into the problems of raw silk classification, and the question of changing the standard size of raw silk to 14/16 denier and the reform or abolition of the Yokohama Exchange can be discussed here to better advantage, from the manufacturers' viewpoint, than in Japan. Also, with raw silk prices continuing their erratic and unexpected fluctuations, very few silk men have expressed a willingness to leave the scene of operations for the length of time necessary to visit Japan.

The Burstein Woolen Company, Chelsea, Mass., manufacturers of woolen rags, bags and burlap, has been incorporated with a capital of $4,000; forty shares all issued for cash. Incorporators: President and treasurer, William H. Hodgkins, 102 Congress Avenue, Chelsea, twenty shares; clerk, August I. Weisberg, nineteen shares; director, Joseph Atkins, one share.

Silk fabrics are now being dyed and finished in the plant of the Continental Dyeing & Finishing Company, Inc., at 414 Eighteenth Street, West New York, N. J. The officers of the firm, all of whom are well known in the silk industry, are: President, Jean Thomas; vice-president, G. Mitchell; secretary-treasurer, Harry Ruvo. Mr. Ruvo is the general manager as well as trade representative, while his two associates manage the dyeing and finishing departments. The firm is conducting a general piece dyeing and finishing business, specializing in crepe de chine and georgettes.

Frank Kelly has been promoted from assistant to boss dyer at the Saranac Mills of the American Woolen Company, Blackstone, Mass., to succeed John J. Heffernan, who has resigned to become boss dyer for the Verdun Worsted Company, Woonsocket, R. I.

The Velvet Textile Corporation, Paterson, N. J., has been incorporated, with a capital of $200,000, to manufacture and sell velvet, plush, pile and other fabrics. The incorporators are Clifford L. Newman, Julia V. Many and Ethel Carnathan.

The Middletown Textile Company has been incorporated, under the laws of Connecticut, with a capitalization of $25,000, to manufacture textile goods, including gloves, by Frank B. and Mary H. Bement and Lowndes A. Smith.

The Dodge Chemical Company, Boston, Mass., has elected Albert N. Lockhart president and Clara F. Dodge, of 20 Waban Street, Boston, treasurer. The company was incorporated on February 1 with $50,000 capital, the incorporators being the officers and Arlita D. Parker.

More than three hundred individual exhibits of all kinds of merchandise will feature the first annual international sample fair to be held in the Seventy-first Regiment Armory, New York, from April 3 to 8, inclusive. Agents, manufacturers, importers and exporters will be represented in the exhibit. The fair is intended by its officials to be strictly a trade and merchandising opportunity, and the general public will not be invited to see it.

Cap Rock Mills, Post, Tex., recently formed, are to build a cotton yarn mill with initial equipment of 30,000 spindles. J. E. Sirrene & Co., Greenville, S. C., are the architects and engineers, and bids on the new mill will be received until August 1 of this year.

Artcraft Silk Hosiery Mills, Philadelphia, Pa., have been formed and a plant at Erie Avenue and Amber Street will be equipped for the manufacture of women's full-fashioned silk hosiery. The product will be sold by the Daisy Whitehead Knitting Company, New York, under the trade name Artcraft Silver Stripe. The organizers of the company are H. A. and J. A. Sacks and Jacob Kugleman.

The Giles Dyeing Machinery Company, Germantown, Pa., specializing in large lot machines, is placing on the market an entirely new dyeing machine. Recently there was shipped from a leading carpet mill a one-piece, plain, seamless chenille rug weighing 3,000 pounds, the wool face yarn alone weighing 1,200 pounds, and this was dyed in one lot. So even was the coloring, it is claimed, that no detectable variation in shade was observable. It is probable that so heavy a rug was never made before and it is claimed that so large a quantity of yarn was never before dyed in one lot.

The D. O. Pease Manufacturing Company, Worcester, Mass., has been incorporated to do a general textile manufacturing business. Capital, $50,000 preferred, 500 shares of a par value of $100 each, and 1,500 common shares without par value. Of this capital, 240 shares preferred and 950 common shares are issued. Incorporators are: President and treasurer, Durell O. Pease, 656 Main Street, Worcester, holding 50 preferred and 349 common shares; clerk, Henry L. Parker, and director, E. Kent Swift, Northbridge, Mass., holding 90 preferred and 300 common shares.

MEN OF MARK
in the
DYESTUFF FIELD

ROBERT E. ROSE, Ph.D.
Technical Laboratory
Director, Dyestuffs Division
E. I. du Pont de Nemours & Co.
Wilmington, Del.

ROBERT EVSTAFIEFF ROSE was born June 2, 1879, in Palermo, Sicily, of Norman-Scotch-English-Italian-Spanish-Russian-American descent. His travels began at the early age of four, when he homesteaded in the Canadian Northwest. Before returning to Europe he went on to California, where his schooling began.

With only two years of study at an English private school, together with what he could gain from outside sources, he matriculated at the age of sixteen in the University of Leipsic, the youngest student enrolled. In 1903 he obtained his Ph.D. in organic chemistry for research under Johannes Wislicenus, the great pioneer of modern carbon chemistry.

At the University of St. Andrews, where he went immediately after obtaining his degree, Dr. Rose not only did very highly specialized research on sugars, but also learned to play golf.

In 1905 he moved to University College, Nottingham, England, where he became familiar with the idiosyncrasies of optically active silicon compounds.

1907 found him Assistant Professor of Chemistry in the University of Washington, where he remained for some years.

In 1917 he became a Fellow at the Mellon Institute of Industrial Research, Pittsburgh, working on the special problems presented by the oil industry.

He entered the employ of the Du Pont Company in 1918 and devoted himself to dye research as assistant to the head of the Organic Research Division of the company, and since the beginning of 1921 has been in charge of the Technical Laboratory of the Dyestuffs Department of E. I. du Pont de Nemours & Co., at Wilmington, Del.

Review of Recent Literature

Textile Raw Materials and Their Conversion Into Yarns. Julius Zipser (translated from the German by D. T. Nisbet); London, England. (Second edition.)

This is the second English edition of the original German work, the first English edition having been published in 1901. The translator has attempted to present the work in an improved form, certain unessential parts having been eliminated, additions made and the book rewritten in part.

The book was originally prepared for students in technical schools as well as for self-instruction on the part of those engaged in the industry. After discussing the important textile raw materials and methods of their detection and estimation in yarns and fabrics, the author takes up the technology of spinning, reviewing the various processes used for both vegetable and animal fibers.

The volume is illustrated with drawings of the various machines involved. It offers to the mill man a knowledge of the raw materials in respect to their derivation, origin, cultivation, collection, form, structure and characterictics, as well as their utilization and conversion into yarn.

The Application of the Principles of Efficiency to the Teaching of Chemistry. J. Norman Taylor, Dyestuffs and Explosives Laboratory, George Washington University. School Science and Mathematics, Dec., 1921; Vol. XXI, No. 9.

This paper, which has since been reprinted in pamphlet form, confines itself to an outline of the principles of efficiency as applied to chemistry teaching without attempting a detailed discussion. Author holds, with Dr. Mann, that complete and true efficiency is material only in its application, and is fundamentally ethical or moral in its nature; individuals or groups of individuals who do not realize and demonstrate the truth that it is servant and not master, are attempting to operate against natural laws. He adopts for the purposes of his article the definition of Harrington Emerson, who declares efficiency to be "mental and physical ability to find and take the best, easiest and quickest ways to the desirable things of life." Author then outlines the thirteen principles of efficiency according to Emerson's latest classification, and under each one mentions its application to the teaching of chemistry, likewise giving practical suggestions as to such application.

These principles, which are at once independent and interdependent, are divided into seven practical and six ethical ones, as follows: Practical: Records, Plans, Schedules, Despatching, Standardized Conditions, Standardized Operations, Written Standard Practice Instructions; Ethical: Ideals, Common Sense, Competent Counsel, Discipline, Fair Deal, Efficiency Reward.

How these principles of efficiency may be applied to the teaching of chemistry so as to secure a maximum of results in a minimum of time should make interesting reading for instructors in this and, perhaps, other sciences as well. There are few men following this important and trying occupation who have not attempted to work out efficiency systems of their own, and for the purpose of reinforcing their own judgment, if for no other, a perusal of the methods outlined in this article should be worth while. Many of the suggestions given are of undoubted value, and in any case, the pamphlet will prove helpful to a majority of our instructors in reorganizing already existing systems, or rounding out and completing them in several important particulars. In short, it may safely be said that the most efficient way of establishing an efficiency system is not by the "trial-and-error" method, but by the study of such a brochure, especially designed to fit the peculiar needs of a specific occupation.

INQUIRY DEPARTMENT

All classes of chemical work or advice relating to artificial colors, natural dyestuffs, dyewoods, raw materials, extracts, intermediates, crudes, or dyeing chemicals and accessories in general, will be carried out for readers and subscribers of the AMERICAN DYESTUFF REPORTER by this department.

Inquiries of a minor character will be answered on this page, while major matters involving personal investigation, analyses, perfected processes and working formulas, will, if desired, be treated confidentially through the mails. In answering inquiries which, by their nature, require reference to the products, processes or apparatus of some particular manufacturer we aim to be absolutely impartial. We refer the inquiries to specialists whom we believe to be best qualified to answer them intelligently, and must disclaim responsibility if their reports show unintentional bias. All questions, materials for analysis or letters leading to the opening of negotiations for special work will receive prompt attention if addressed to Inquiry Department, American Dyestuff Reporter, Woolworth Building, New York City.

D. B. M.—*Question:* We are installing a Franklin Process Machine and expect to dye sulphur blacks with same. We require a very stiff yarn and wish to ask whether you would deem it advisable to omit a softener, such as turkey red oil, from the wash water in order to retain stiffness in the yarn.

Answer: It would be entirely practicable to omit a softener from the wash water in order to retain stiffness in the yarn; however, the yarn should be thoroughly washed.

The only precaution to be used to prevent tendering is to chrome the black after dyeing it.

L. L. S.—*Question:* Will you please advise me as to what soluble mordant might be incorporated with gelatine with a view to precipitation of such dyes as Patent Blue and Quinoline Yellow?

Also, can Acid Cyanine G, or its equivalent be obtained in the United States?

Answer: Barium chloride precipitated with sulphuric acid forms barium sulphate, which, incorporated with gelatine, will accomplish the result outlined in the first paragraph of your letter.

In regard to the second paragraph, Acid Cyanine G,

or its equivalent, is not obtainable in the United States, unless possibly from the Eastman Kodak Company, who might make it for their own use; but whether or not they make it in commercial quantities we cannot say.

C. C. D.—*Question:* If chroming prevents tendering of goods dyed with Sulphur Black, as stated in your department of The Reporter for February 13, why do not manufacturers of Sulphur Black recommend that process with their product?

Answer: Several of the large manufacturers of Sulphur Black inform us that they do, as a matter of fact, recommend after-chroming as a means of preventing tendering of goods dyed with this product. There seems to be no question but that after-chroming is generally accepted as a suitable means to this end.

J. N. T.—*Question:* I am dyeing worsted pieces with resisted silk effects but find that my whites are generally tinted yellow. I use after-chromed dyes. Does the dye or the chrome cause the tinting?

Answer: The general practice is to have the colors resisted but to make the whites with pure silk only. The reason for the staining is that the action of bichromates on the tannic acid, used for resisting, produces a yellow pigment. Care should be used to select a line of dyes that do not stain silk and then see that there is a perfect exhaust of the dye bath. In the case of Carmoisine a complete exhaust cannot be obtained if any Glauber's salt is used and 15 to 20 per cent of acetic acid is necessary. Many other chrome colors give clearer silk if the Glauber's salt is omitted. After dyeing, even under the most favorable conditions, the silk is often slightly tinted and it is customary to clean with 2 per cent of hydrosulphite at 120 deg. Fahr.

Recent Patents

Dyeing Apparatus

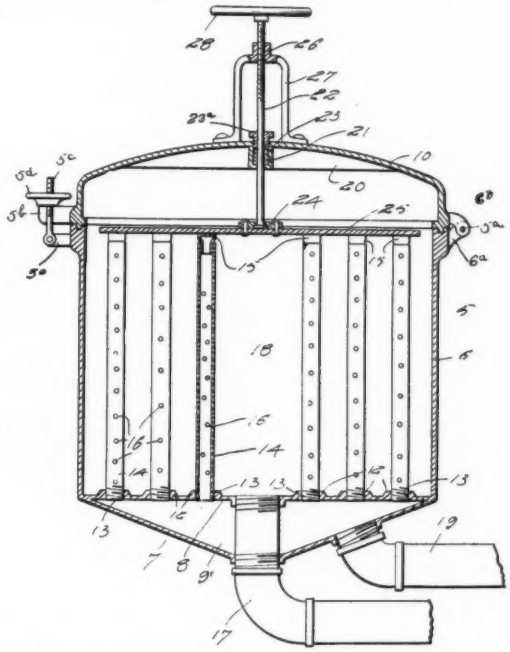
(1,405,299; January 31, 1922)

Wade H. Davis, Rosemary, N. C.

The object is to enable the bundles of yarn or like material to be evenly compressed throughout the mass within the treating apparatus whereby an even flow of liquid may be distributed throughout the mass of fibrous material, and to accomplish this result with economy of labor and of time.

It comprises an improved apparatus of the type in which bundles of yarn or similar fibrous material are sustained on holders adapted to permit a flow of liquid laterally therefrom or thereto throughout their lengths and enable said liquid to be evenly distributed throughout the fibers in the bundles held on them. The apparatus is so constructed that flow of the liquid treating material may pass laterally through the holders and out through the yarn or reversely through the yarn and out through the holders. The kier or treating container comprised in this apparatus is entirely open at the top, exposing the entire cross section of the container; and it is provided with a cover adapted to be fitted fluid tight, or to be opened to expose completely the top of the kier, and is preferably hinged to outward projecting brackets so that the cover may be turned 90 deg. or more on the hinge, affording full vertical clearance above the kier, and permitting it to approach its seat in closing at a relatively small angle so as to avoid applying material side pressure to the yarn or the like that may extend above the holders.

The illustration is a vertical section through one form of the improved apparatus.



A tank or kier is indicated, generally, in the drawing by the numeral 5. This kier has a cylindrical wall 6 and a generally conical bottom 7. Crossing the interior of the tank or kier 5 above the conical bottom at the junction thereof with the cylindrical wall 6 is a septum or partition 8 provided on its upper surface with a number of bosses 12 through which central threaded perforations 13 extend. Threaded into the perforations 13 are an equal number of yarn holders 14 consisting of tubes projecting upward in parallel relation to a level approximating the top of the tank wall 6. The upper ends of these tubes are closed by the plugs 15, which may be screw threaded or permanently secured to the upper ends of the tubes. The walls of the tubes are perforated as shown at 16 with numerous orifices adapting liquid to flow laterally from the tubes in substantially all directions throughout their lengths. The lower ends of said holders or tubes 14 open into the compartment 9 formed between the conical bottom 7 and the partition 8.

A pipe 17 passes through the apex of the tubular bottom, extends through the chamber 9 and opens into the chamber 18 above said perforated partition. A pipe 19 is tapped into the conical bottom 7, said pipe opening into chamber 9 between the bottom 7 and the partition 8.

A hinge bracket 6a extends outward from adjacent the upper margin of the cylindrical wall 6, and a similar hinge bracket 6b projects from a cover 10, the hinge pintle 5a being passed through said brackets whereby the said cover 10 is hingedly connected to the kier 5. Projecting radially at one or several points around the edge of the cover 10 are pairs of spaced ears 5b. Hinged to lugs 5e projecting from the wall 6 of the kier 5 at points beneath the projecting ears 5b are bolts 5c adapted to project between the ears 5b. Threaded on each bolt 5c is a hand nut 5d. By means of the bolt 5c and nut 5d the cover 10 may be screwed tightly down upon the top of the walls 6 of the kier 5 in order to produce a fluid tight joint. The joint shown is preferably a tongued and grooved joint and may be provided with a suitable gasket if necessary, the upper portion of the wall being shown as thickened to provide therefor. The under side of the cover 10 may be supplied with suitable strengthening ribs 20. Centrally of said cover a gland 21 is provided containing packing material 23, and a follower 23a for confining it. Through said gland extends the rod 22 having a swivel connection, as shown at 24, with a presser plate 25 of sufficient area to extend over the top of all of the holders 14. The upper portion of the rod 22 is threaded, as shown at 6, into a bracket 27, and carries on its extremity a hand wheel 28 by means of which said threaded rod 22 may be rotated in the threaded portion of the bracket 27 and elevate or depress the plate 25.

In use, the cover 10 will be opened fully, and in the construction shown it is preferred to use a hoist for lifting said cover. In the usual practice balls or parcels of yarn, wound on cores consisting of coil springs covered with pervious fabric, will be threaded over the holders 14. The lower parcels of this yarn, resting on the bosses 12, will be elevated above any sediment that may collect on the plate 8. The upper parcels of yarn will extend above the tops of the holders 14. After the holders have been loaded with an equal number of parcels on each, or such a number of parcels as will bring the tops of the yarn threaded on the holders 14 to substantially the same level above the tops of said holders 14, the cover 10 will be lowered to position, the plate 25 having meanwhile been withdrawn or raised toward the upper side of the cover by manipulating the hand wheel 28. The hinged bolts 5c will then be turned upward so as to pass between the pairs of ears 5b and the nut 5d will be turned down so as to clamp the cover fluid tight to its seat. Thereafter by turning the hand wheel 28 the presser plate 25 will be forced downward applying even pressure to the masses of yarn held on the holders 14. It is not necessary to apply a heavy pressure on the yarn, the purpose being to get an even pressure throughout the mass so that the bleaching or dyeing liquid will be applied evenly to the entire mass. After the yarn has been compressed as described the bleaching or dyeing liquid may be forced through one or the other of the pipes 17 or 19. Should it be forced first through the pipe 19 the liquid will pass into the chamber 9 and thence up through the holders 14 and be disseminated throughout the bundles of yarn held thereon and will return through the pipe 117 to the source of supply. The flow of liquid may be reversed, as by a four way valve, in the well-known manner, and cause to flow in through the pipe 17 to the chamber 18 and through the bundles of yarn from the outside returning through the holders 14 into the chamber 9 and back through the pipe 19. Reversal of the dyeing or bleaching liquid in this manner is known and no further description thereof need be given.

The form of apparatus illustrated is particularly adapted for large kiers designed to treat a large mass of yarn at one treatment and wherein it will be difficult to close the cover by hand and apply by the closing of the cover the necessary pressure to the yarn. The presence of the adjustable presser plate 25 manipulated by the screw 22 enables the cover to be closed and screwed down by hand and the necessary pressure afterwards applied.

Apparatus for Treating Wool, Slubbing, Yarns, and Other Fibrous Material

(1,405,038; January 31, 1922)

Joe Kershaw, Menston, England

This invention relates to machines or apparatus for dyeing, mordanting, bleaching, scouring or similarly treating with liquors or liquids wool, slubbing, yarn, wool and cotton wastes, woolen and cotton warps, hose, rags, jute and all raw materials in which the material during treatment is placed in a tank or vat between a vertically reciprocating perforated or the like false bottom and a stationary lattice or the like top and is repeatedly squeezed or compressed when saturated with the liquor or liquid and allowed to open out or expand after each compression, and it relates particularly to the machine or apparatus described and illustrated in the specification of British Letters Patent No. 122,227, in which the lift of the false bottom can be varied to suit the bulk or weight of material under treatment. and the object of the present invention is to facilitate and expedite the handling of the material under treatment.

In accordance with this invention the tank or vat is provided with a perforated or the like inner cage to receive the material under treatment. The cage which is open at the top is divided horizontally into two or more sections fitting each other telescopically and when in its working state rests on the false bottom with the top section connected by suitable means to the stationary lattice or the like top. The bottom of the cage is provided with a door or doors to allow for the removal of the treated material contained therein.

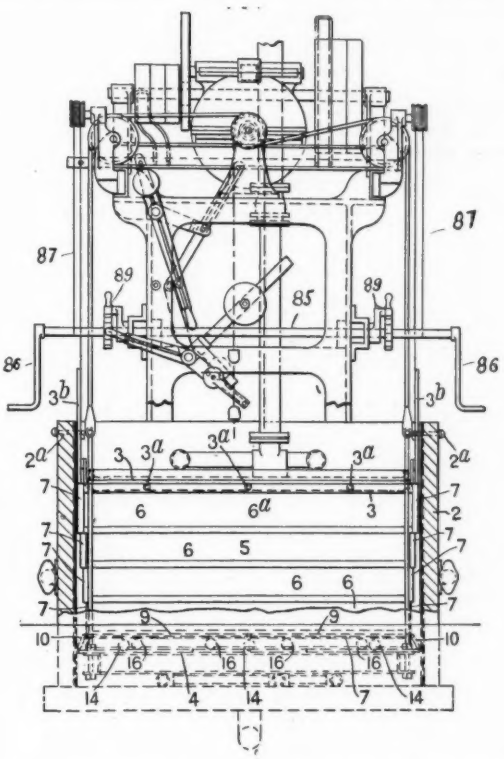
When the material under treatment is in hank form it is preferably carried on the usual sticks supported in end plates which are slideably mounted in suitable guides secured to the lattice or the like top so that the end plates and the sticks with the material can readily be removed. Also when the material is in hank form it is found advantageous to impart to the false bottom a quick upstroke or lift and a slow down-stroke or fall with or without a dwell at the bottom of its stroke and this is accom-

plished by altering the diameters of the two sets of fast-and-loose pulleys or the diameters of the pulleys driving same, or by altering the diameters of both, or in any other convenient way.

The cage or the end plates carrying the treated material is transferred from the machine or apparatus to an open box like truck provided with suitable guides to receive the cage and both the false bottom and the guides on the truck and also the end plates and both sets of guides on the machine or apparatus and the truck are preferably made by means of runners or anti-friction rollers in order that the cage in its telescoped or collapsed state or the end plates can readily be transferred to the truck.

The illustration is an end view, showing the bottom part of the front end frame broken away and the upper part of the tank or vat in section, and showing the parts in the operative position.

Referring to the drawing, 2 designates the tank or vat, 3 the lattice or the like top and 4 the perforated or the like false bottom. 5 is the inner cage divided horizontally into sections 6 fitting each other and connected together telescopically with the top section 6a preferably on the outside. The top section 6a is connected to the lattice top 3 by means of pine 3a engaging holes in said top section, and the lattice or other top 3 is fixed within the top of the tank or vat by pins 2a engaging holes in the sides of the tank or vat, and a horizontal set of holes in the vertical strips 3b. The lattice top is adapted to be raised and lowered by means of a cross shaft 85 journaled in bearings in the side frame or brackets secured thereto. The shaft is rotated by means of two crank handles 86, one at each end thereof. A flexible chain or wire rope 87 is connected to each of the metal strips or rods 3b secured to and supporting the lattice top, said chain passing over a guide pulley pivoted to a fixed bracket on the side beam, the chain being connected at its opposite end to the cross shaft 85 or a drum secured thereon. The lattice top is prevented from descending when in a raised position by means of a ratchet and pawl arrangement 89. The cage rests on the false bottom 4 and when in its working state the top section 6a is connected by means of pegs or other suitable means to the lattice or the like top 3 which is fixed within the top of the tank or vat 2. In operation the cage and the material contained therein are compressed against the stationary lattice or the like top during the slow up-stroke or lift of the false bottom and both the cage and the material contained therein are allowed to open out during the quick down-stroke of the false bottom and the material is further allowed to open out or expand during the dwell of the false bottom at the bottom of its stroke. The cage is composed of perforated sheet metal, copper or galvanized iron, connected together in sections 6 by means of strips 7 of angle iron and countersunk head rivets and the sections are limited in their sliding movement by means of beadings 3 at the top and the bottom of each section. The perforated bottom of the cage is made in two halves or doors 9 slideably mounted and provided with handles 10 at their outer ends to facilitate the drawing apart of the doors so that the treated material may fall out of the cage into a convenient receptacle. The cage is supported on the false bottom and on suitable rail guides provided over the top of the truck by means of runners or anti-friction rollers 14 in order that



the cake can readily be run off the false bottom on to the rail guides, or vice versa. The runners or anti-friction rollers are mounted in the bottom of the cage at opposite sides of same and the doors 9 are provided with strengthening pieces provided also with anti-friction rollers 16 which are in contact with the false bottom 4 so that there is less liability of the bottom of the cage bulging out when the material is under compression.

Method of Coating Fabrics

(1,405,198; January 31, 1922)

DANIEL D. FROTHINGHAM and RALPH U. SAWYER, Winchester, Mass.

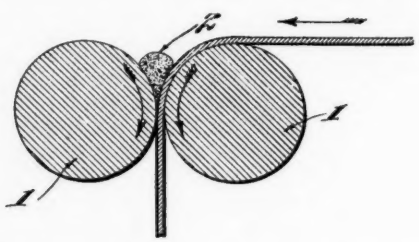
The object of this invention is to produce a coated fabric of improved quality and at reduced cost. The drawing illustrates a transverse section of two coating applying rolls, showing the fabric entering from one side and passing down between the rolls, in the nip of which the coating is applied by roll pressure.

The coating consists of any usual fabric coating material and may conveniently be made of celluloid and a solvent, and will, in preferred form, contain pigmentous material as distinguished from soluble coloring material.

Heretofore coatings of this character have been applied to fabrics by the use of a "spreader" or by use of

rolls arranged vertically one above the other, between which the cloth is passed, and on the upper surface of which, at the nip of the rolls, the coating material is applied. This coating material gathers in a roll at the nip, the pressure of the rolls upon each other determining the thickness and degree of impregnation of the fabric by the coating. In such former process, the action of the coating rolls upon the coating material as the fabric is passed through the rolls has been such as to separate a portion of the solid pigmentous material from the coating, with the result that the coating applied to the fabric has been deficient in pigment. This detracts from both the value and appearance of the finished product. The phenomenon appears to be due to the force exerted by the rotating rolls or spreader upon the solid particles of pigment causing the latter to be moved rearwardly through the fluent coating and in a direction from the nip of the rolls. This method has produced a coated fabric wherein the coating contains less pigment than is desired.

Inventors declare that if the cloth moves down between the rolls, or down against the face of a spreader bar, the action of gravitation upon the solid particles of pigment has resulted in their being carried into the nip between the rolls, or, by the spreader bar, so that the pressure actually drives the coating into the fabric and the latter contains the same amount of pigment originally carried



by the coating material. Thus, when the coating rolls 1, 1 are arranged with axes in the same horizontal plane as shown, the action of gravitation upon the pigment in the coating material 2 at the nip of the rolls causes the pigment to be drawn in between the rolls with the fluent portion of the coating material. This method is particularly adapted for use in applying the coating by a rapid passage of the cloth between the coating rolls, in which case the fluent portion of the coating material is in a free-flowing condition as distinguished from a stiff or viscous condition, although it is also useful in the application to fabrics of coating in a stiff or viscous condition, as it has been found that even in such a stiff or viscous coating material the particles of pigment are assisted in their movement by gravitation.

In the illustration, the cloth approaches the rolls in a horizontal plane and passes around one roll and down between the two rolls, through the nip of the rolls, where the coating is applied.

While the method is more especially adapted, as has been indicated, to coating cloth with solid-pigment-bearing coating material, it is also adapted to the coating of cloth with coating material containing only soluble coloring matter, because the action of gravitation upon the nip of the rolls increases the penetration of the material into the fabric.

The method is especially adapted for use in applying thin, as distinguished from thick, layers of coating to fabrics, a considerable portions of the coating material actually penetrating the surface of the cloth in the operation of coating.

The resulting product is one in which the coating is firmly united with the fabric and in which the surface of the coating being so small a distance from the surface of the fabric, the coated material is capable of being bent in a direction to stretch the coated surface without the fracture of the surface. In ordinary pigment-bearing coatings, the coating, being farther removed from the surface of the fabric, is liable to be cracked by bending the coated surface convexly.

Dyeing Machine

(1,405,341; January 31, 1922)

ADAM W. SEHN, Cincinnati, Ohio

In the process of dyeing many delays occur, the dyeing is done unevenly and what are known as "heat wrinkles" are present in the work; loss being incurred, as many of the defects are not always noticeable until the dyed work is being pressed.

One of the salient features of this invention consists in the use of a paddle wheel formed and constructed in such manner that its blades strike the dye liquor in the tank, and which prevents the "carrying over" of goods in the dye tub. The paddle wheel also prevents tearing and bunching of the garments, and permits the dye liquor to readily run off the paddles or blades, thus insuring superior action and operation.

Another feature consists in providing a series of conveniently disposed pipes for steam, hot water and cold water, so that any of them can be used separately or conjointly at any time.

The illustration is an isometric view of the machine.

The dyeing tub is marked 1, and is usually oval in configuration, and in its center is placed an oval, hollow upright post or fixture 2, an oval path being present between the post 2 and the wall of the tub 1, to form a route or passageway for the goods which are being dyed; the walls of the hollow post 2, provided with openings, which pass therethrough; and as many of these openings may be used as desired, a pipe 5 passes down into the hollow post 2 until it reaches the bottom, where it passes through the wall forming said hollow post extending out to form a nozzle provided with holes. With the pipe 5 are connected, at its upper extremity, the pipes 9, 10, 12; the pipe 10 may be a continuation of the pipe 5, these pipes are each governed by a valve 13, each pipe having such a valve.

One of these pipes is used for steam, another for hot water and the other for cold water, so that any can be used when occasion requires.

On the shaft 14 is mounted and supported a paddle

wheel formed of a hexagon hub provided with paddles or blades. A bracket 19 consists in holding up the bearing. There is further provided an upwardly extending bracket arm 20 having a supporting arm. The bracket arm 20 at the base of which is the bearing in which the shaft 14 is journaled, extends therethrough and a large gear is fastened thereon, a smaller gear which meshes with the first mentioned being placed on another shaft, the tight and loose pulleys 25 and 26 being placed on the same shaft.

A shifter rod 27 is provided with fingers 29 and 30 and the belt can be shifted to the right or left onto pulleys 25 or 26, as needed. The gears are covered by a guard 31.

The machine operates as follows: The dyeing liquor is placed in the tub or receptacle 1; the belt is shifted to a proper pulley and this revolves the shaft within them, thus revolving the small gear, which, meshing with the large gear, revolves the shaft 14, which carries around the paddle wheel; blades of which strike the dyeing liquor at any desired point; the blades 18 of the paddle wheel striking the dyeing liquor forces it around the path between the walls of the tub 1, and the hollow post 2; the paddle wheel revolving in the direction shown by the arrow. The dyeing liquor is thus kept in the state of agitation and in a revolving course over the path; the articles, clothes or other things to be dyed also pass over this course carried along by the dyeing liquor and the paddles 18 of the paddle wheel; hot or cold water or steam can be run into the hollow post, through pipe 5 as desired, and it will pass out through holes in the base of pipe 5, in the same direction as the dyeing liquor is running; the hollow post 2, having a multiplicity of holes to allow the proper circulation.

The hub of the paddle wheel is hexagon in shape, so that the blades or paddles 18 thereof are placed on the hexagon sides of said hub; this enables the dyeing liquor to quickly pass off of the blades when said paddles are in their upward course, and also enables any articles, clothes, fabrics or the like which have been caught up by the paddle wheel to quickly and readily fall off, back in the dyeing liquor, preventing any tearing of the articles or clothes and preventing bunching; thus more thoroughly allowing the dyeing liquor to produce its proper and expected result in dyeing the clothes or the like.

The edges of the blades of the paddle wheel are usually rounded, but may be made in any other shape or contour which will give the result desired, and it may be revolved in any other desired manner.

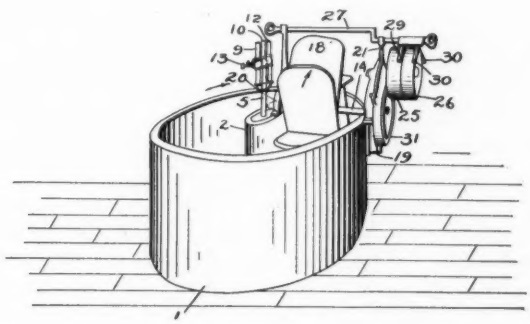
It will readily be observed that by use of the dyeing machine a continuous, uninterrupted and efficient operation results, thus quickly and thoroughly dyeing the clothes or other articles operated upon, assuring high class dyeing and preventing variety or shape of color, producing uniformity of color and evenness of the work done.

The following claims are granted:

1. A dyeing apparatus including a tank having an unobstructed annular chamber adapted to contain dye liquid, and a rotatable paddle wheel for circulating said liquid around said chamber, said wheel having blades disposed tangentially to the axis of rotation.

2. A dyeing apparatus including a vat having an endless unobstructed chamber therein designed to contain dye liquid, and a rotary paddle wheel for circulating the liquid around said chamber having blades arranged tangentially to the axis of rotation of the paddle wheel.

3. A dyeing apparatus comprising a tank provided with an endless unobstructed chamber designed to contain dye liquid a horizontally disposed shaft, and a paddle wheel mounted on said shaft and provided with paddles dis-



posed tangentially to the axis of said shaft, said wheel extending into said chamber for circulating the liquid around said chamber.

4. A dyeing apparatus including a tank having an open top and provided with an endless chamber, a central chamber arranged within the other chamber, a supply pipe extending through the central chamber and having an angular extension projecting into the endless chamber and provided with apertures arranged at one of its sides and a paddle wheel for circulating the dye liquor around said endless chamber.

5. A dyeing apparatus including a tank provided with an endless unobstructed chamber designed to contain dye liquid, a horizontal shaft, a hub mounted on said shaft and having a hexagonal periphery, and paddles fixed to the faces of the hexagonal periphery and arranged tangentially to the axis of said shaft for circulating the dye liquor in the tank.

Vat Dyestuffs and Process of Making Same

(1,405,446; February 7, 1922)

JULIUS SCHMIDLIN, Basel, Switzerland, and WALTER BRUNNER, Mainkur, near Frankfort-on-the-Main, Germany

Inventors have found that valuable vat dyestuffs of very useful dark shades, having a great affinity for the animal fiber, are obtained by heating in aqueous or alcoholic solution with alkaline sulphides to advantage with ammonium sulphide (preferably under pressure) the m-nitroarylides of the halogenated benzoquinones. This observation is all the more surprising as benzoquinone-o-nitranilide is converted with ammonium sulphide into quinone-homofluorindine (Berichte 23, 2793) a sub-

stance, representing a dyestuff insoluble in alkali and hydrosulphite and thus not applicable as vat color.

As starting materials for the new process the products may be used which are obtained in the usual manner by condensation of the halogenated benzoquinones with a m-nitroarylamine as m-nitraniline or its substitution products, for instance chlor-m-nitraniline, m-nitrotoluidine, m-nitrophenetidine (the nitro group always being in m-position to the amino group). According to the nature of the nitroarylamine and likewise according to the alkaline sulphhide used as sulphurizing agent, and according to the temperature and duration of the reaction the shades obtained vary from brown to greenish to blackish brown.

The new dyestuffs are dark powders insoluble in water and in most organic solvents. They show a characteristic coloration with sulphuric acid, yielding violet to blue to greenish blue shades. With alkaline hydrosulphite yellow to brownish yellow colored vats are obtained, from which wool is dyed in very fast shades.

The process is illustrated by the following example:

Ten parts of chloranil-m-nitranilide (obtained by condensation of chloranil with m-nitraniline) are introduced into 250 parts of aqueous ammonium sulphide and the whole is heated for some hours to about 120 deg. Cent. After cooling down the dark precipitate is filtered off and washed with water. The new dyestuff thus obtained dissolves in concentrated sulphuric acid with a violet blue color and forms with alkaline hydrosulphite a yellow colored vat from which wool is dyed full grayish brown shades.

The same starting material yields an intensely greenish brown dyestuff by heating one part of it with a solution of 6 parts of crystallized sodium sulphide in 20 parts of water and precipitating with acids the dyestuff formed after several hours' boiling.

The chloranil-m-nitranilide being replaced by the same quantities of the condensation products of chloranil and chlor-m-nitraniline ($Cl:NO_2:NH_2=1:2:4$), or nitrophenetidine ($OC_2H_5:NO_2:NH_2=1:2:4$) and being heated with an aqueous or alcoholic solution of ammonium sulphide similar dyestuffs are obtained dyeing wool from the vat brown respectively blackish brown shades.

Claims are granted as follows:

1. The process of manufacturing new vat dyestuffs by heating with alkaline sulphides the m-nitroarylides of the halogenated benzoquinones (obtained by condensation of the halogenated benzoquinones with m-nitroarylanines).

2. The process of manufacturing a new vat dyestuff by heating with ammonium sulphide under pressure the chloranil-m-nitranilide (obtained by condensation of chloranil with m-nitraniline).

3. As new products the hereinbefore described new vat dyestuffs obtainable by heating with alkaline sulphides the m-nitroarylides of the halogenated benzoquinones (obtained by condensation of the halogenated benzoquinones with m-nitroarylamines), said dyestuffs being dark powders insoluble in water and in most organic solvents, soluble in concentrated sulphuric acid with a violet to a blue to a greenish blue color and dyeing wool from the vat shades varying from brown to greenish brown to blackish brown shades of great fastness and intensity.

4. As a new product the hereinbefore described new vat dyestuff produced by heating with ammonium sulphide under pressure the chloranil-m-nitranilide (obtained by condensation of chloranil with m-nitraniline), said dyestuff being a dark powder insoluble in water and most organic solvents, soluble in sulphuric acid with a violet blue color and dyeing wool from the vat full grayish brown shades of great fastness and intensity.

Azo Dyes

(1,405,687; February 7, 1922)

RUDOLPH HAUGWITZ, Friedrichshagen, near Berlin, Germany (assignor to Actien Gesellschaft fur Anilinfabrikation, Berlin).

This consists of new azo dyes derived from a diazo compound and an 8-hydroxy-derivative of quinoline, for instance of 8-hydroxyquinoline-sulphonic acid made by sulphonating 8-hydroxyquinoline. As diazo-compounds most adapted are those which are derived from aminoarylsulphonic acids of the benzene series. The manufacture is executed in the known manner by coupling the components in an alkaline menstruum. The dyes thus prepared are brownish powders which dye wool from aqueous solutions orange tints becoming fast to washing and milling when treated with chromic acid or chromates, yellow to brownish chromium lakes being formed. By strong reducing agents the dyes are destroyed.

Example:

19.5 parts of sodium aniline-3-sulphonate are diazotized in an aqueous solution by means of 50 parts of hydrochloric acid of 112 deg. Be. and 7 parts of sodium nitrite. The diazo-compound is then mixed with an aqueous solution of 22.5 parts of 8-hydroxyquinoline-sulphonic acid and 30 parts of calcined sodium carbonate. After combination the dye is salted out and dried. It dyes wool orange tints. After treatment with potassium bichromate a reddish yellow dyeing is obtained.

Two of the four claims allowed are:

1. The new dyes forming on wool yellow to brownish chromium lakes and being sulphonic acids of the azo dyes which may be derived from a diazotized aromatic amine and 8-hydroxyquinolin and correspond to the formula:

$$aryl—N=N—C_9H_5N.OH.$$

2. The new dyes forming on wool yellow to brownish chromium lakes which may be derived from a diazo-arylsulphonic acid and an 8-hydroxy-derivative of quinolin and correspond to the formula:

$$HO_3S—aryl—N=N—C_9H_4NX.OH$$

where X means hydrogen or a substituent.

Apparatus Employed in the Manufacture of Artificial Silk

(1,406,153; February 7, 1922)

James Clayton, Coventry, England (assignor to The Viscose Company, Marcus Hook, Pa.)

This relates to machines employed in the manufacture of artificial silk, the said machines being of the kind operating in accordance with what is known as the Topham system wherein viscose, or the like, is ejected from a nozzle into a setting bath and the threads formed are led under an immersion guide and up over a rotating drawing-roller guide (known as a Godet), and then down through a thread-guide, or funnel, into a rapidly rotating spinning-box in which the thread is coiled, the circumferential velocity of the rotating drawing-roller guide, or Godet, determining the rate of passage of the thread into the spinning-box.

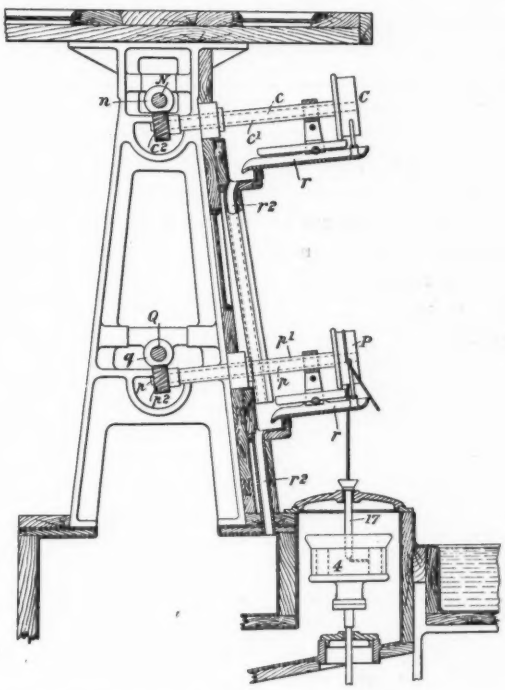
Inventor has found that the operation of initially passing, or threading, the thread through the thread-guide, or funnel, is much facilitated, especially in cases where it is desired to run the machine at a high speed, if means be provided whereby the thread is, during the threading operation, subjected to the action of a drawing-roller guide, or Godet, which has, during such operation, a circumferential velocity slower than that which the drawing-roller guide or Godet has when the thread is passing thereover on its way to the spinning-box during normal working of the machine. This invention is adapted, for instance, for use in an apparatus in accordance with inventor's application, Serial No. 309509, A. D. 1919, for Letters Patent, in which apparatus, the ordinary drawing-roller guide, or Godet, can be run so much more quickly than is done in ordinary machines that, without some provision according to the present invention, the full advantage of greater speed of output will not be practically obtainable owing to the difficulty of passing the thread through the thread guides, or funnels, when the drawing-roller guides, or Godets, are running at high speed.

The drawing shows, in vertical transverse section the upper part of a machine to illustrate the application of this invention thereto when there is employed an additional Godet, upon a shaft separate from that of the ordinary Godet, over which the thread passes, through the thread guide, or funnel, and into the spinning-box when the machine is normally at work.

The spinning box is marked 4 and the thread guide or funnel is marked 17. The ordinary Godet is marked C and is shown as being driven by a scroll wheel n on the shaft N, engaging a scroll wheel c^2, on the shaft c, of the Godet C, which shaft c, is carried in the long tubular bearing c^1.

P is an additional Godet, provided in accordance with the present invention. It is shown as being mounted on the shaft p (carried in the long tubular bearing p^1) which has on it a scroll-wheel p^2 which engages with a scroll-wheel q, on a shaft Q, which is driven by any suitable gear at a slower circumferential speed than that at which the Godet C is driven. This can, for example (assuming the Godets C and P to be, as shown, of equal diameter), be conveniently effected by reducing gear conveying motion from the shaft N to the shaft Q, or, if desired, the additional Godet P can be of a diameter so much smaller than the diameter of the ordinary Godet C, that the Godets C and P can be driven at the same speed and have the desired difference in rate of circumferential velocity.

Satisfactory results are obtainable if the Godet P be driven at a circumferential velocity of 125 feet per minute and the Godet C at a velocity of 250 feet per minute.



When thread is to be passed through the thread-guide or funnel 17, to the spinning-box 4, the said thread is passed over the slow moving Godet P and can then be much more readily threaded through the said guide, or funnel 17, than would be the case if the thread were passed over the quick moving Godet C. After threading (which may be done in the usual way) is effected, the thread is transferred from the Godet P, to the Godet C, and coiling of the thread into the spinning-box proceeds.

The troughs r and channels r^2 are for carrying liquid which drips from the Godets, into the space below and thence away to any suitable receptacle.

Method for Determining the Quantity of an Appropriate Chemical That Should Be Added per Unit of Volume of Water in Order to Fit It for Use in the Arts

(1,405,940; February 7, 1922)

Cyrus William Rice, Philadelphia, Pa.

Some water contains what is called temporary and permanent hardness, and it is customary to treat such water by the addition of chemicals adapted to remove or absorb the hardness so as to fit the water for use in boilers and

for other purposes. The hardness of a supply of water frequently changes, so that it is often necessary to ascertain at comparatively short intervals of time how much of the appropriate chemical should be added to correct the changing hardness of the water.

The principal object of the present invention is to provide a method of ascertaining the quantity of chemical required to remove temporary and permanent hardness from water which is so quick and easily practised that even comparatively unskilled persons can make the ascertainment in a very short time and so insure proper treatment of the water supply.

Generally stated, the method of ascertaining quantity of an appropriate chemical required to remove the temporary and permanent hardness as it exists from time to time in a given water supply consists in treating a measured sample of the water with an appropriate chemical for removing temporary and permanent hardness, using such chemical in excess under heat control and determining quantitatively the unused quantity and change nature of such chemical.

Free or half bound carbonic acid present as bicarbonate is usually referred to as temporary hardness, and sulphates of calcium and magnesium are usually referred to as permanent hardness.

In practice there is added to a measured quantity or sample of the water to be treated sodium carbonate or potassium carbonate, which are equivalents, in excess of the quantity required to destroy or absorb any permanent and temporary hardness that might possibly be present. For example, to one hundred cubic centimeters of water there is added five cubic centimeters of one-fifth normal solution sodium carbonate or its equivalent. The sample may then be boiled in a bath. This promotes the reaction. Thereafter the sample is filtered. The result of this is that calcium and magnesium sulphates are converted into carbonates and precipitated, thus removing though not ascertaining the quantity of the permanent hardness from the sample, and that sodium bicarbonate and sodium sulphate are formed and are present in the filtrate along with sodium carbonate. It may be remarked that sodium bicarbonate in the presence of excess sodium carbonate is stable even when the solution is boiled within a water bath. The filtrate containing sodium as bicarbonates and carbonates and also sodium sulphate, is titrated with the same mineral acid, as sulphuric acid or hydrochloric acid of known strength or standard solution, first against an indicator of the phenolphthalein class which is peculiarly sensitive to carbonic acid, until the color of the indicator is destroyed, and then against an indicator of the cochineal class, which is more sensitive to alkalinity than indicators of phenolphthalein class. The quantity of acid required in the phenolphthalein titration does not exactly correspond to the quantity of sodium carbonate present but must be multiplied by two, so that twice the quantity of acid represents the quantity of carbonates introduced into the water and unused in any of the reactions. The quantity of acid required in the cochineal titration minus twice the quantity of acid used in the phenolphthalein titration represents the quantity of carbonate of sodium used to replace the calcium or maknesium bicarbonates originally present in the sample of water and so is a measure of the temporary hardness. The total amount of carbonate of sodium originally introduced minus the quantity of acid used for the cochineal titration, which represents the unused carbonate of sodium and the amount of carbonate of sodium used to replace the calcium and magnesium bicarbonate originally present in the water, represents the quantity of carbonate of sodium used in the reaction by which the permanent hardness was precipitated. For example, let z indicate in terms of acid the total amount of sodium carbonate or hardness removing chemical, and x, the amount of acid used in the first titration, and y, the amount of acid used in the second titration. Then $y - 2x =$ temporary hardness and $z - y =$ permanent hardness. In the described process neither the temporary nor permanent hardness were actually determined save by the above calculation. Another way of expressing the same facts is to say that $2x =$ the quantity unused, $y =$ the quantity unused and the quantity used in destroying temporary hardness, and $z =$ the total quantity used.

A very important part of the method directly influencing the results is the use of carbonate of sodium in excess with heat under the definite control of a water bath. The use of a water bath permits a rapid absorption by the carbonates of sodium of the half-bound carbonic acid gas from its loose combination with the carbonates of calcium and magnesium and also of the carbonic acid gas as it exists free in the water and forms by these means the bicarbonates of sodium. The carbonates of sodium under the heat control of a water bath act as a carrier for the elements causing temporary hardness. The determination is in terms of quantity of acid or standard solution used and from this chemists can calculate or ascertain the quantity of an appropriate chemical, as corbonate or hydrate of sodium of potassium or their equivalents that should be added per unit of volume of the supply to free it from both the permanent and temporary hardness. In actual practice inventor simplifies the commercial application of his process by providing a chart graduated to show how much by weight of an appropriate chemical or chemicals is to be added to each unit of volume of water for various increments in volume of mineral acid or standard solution used in the manner described. Phenolphthalein and cochineal are examples of substances adapted to operate in the manner described in the volumetric analysis above explained. The feature of the invention is the use of sodium or potassium carbonate in quantities sufficient to destroy in the water, being tested, both the sulphates of lime and magnesia and also absorb without their disassociation by heat all free or half-bound carbonic acid gas contained in waters as carbonic acid or the bicarbonates of lime and magnesia, the resulting carbonates or bicarbonates of sodium or potassium indicating through a single acid titration the temporary or permanent hardnesses to be overcome in order to fit the water for use in the arts.